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Lower Cretaceous Ammonites from Colombia, South America

BY OTTO HAAS

INTRODUCTION

The present paper attempts to summarize the paleontological results of an investigation carried out early in 1956, under the sponsorship of International Petroleum (Colombia), Ltd., in the Cordillera Oriental of Colombia for the purpose of clarifying and refining the lower Cretaceous stratigraphy of that region. I am indebted to the company for permission to publish this paper and to utilize photographs made at the company's expense, and to Prof. Gerardo Botero Arango of the Facultad Nacional de Minas of Medellin, Colombia, for permission to describe specimens collected on a field trip of that institution and now deposited in its collections. For the repositories of illustrated specimens, reference is made to the legends of the figures accompanying the present report; there "I.P." indicates the collections of International Petroleum (Colombia), Ltd., in Bogotá and "F.N.M." those of the Facultad Nacional de Minas in Medellin.

In addition to most of the forms recognized among the abundant ammonites collected in the course of the above investigation, some interesting specimens that had been in the company's collections earlier are also included in the present report.

Unfortunately most of the ammonites here described, especially those preserved in shales, are crushed and flattened or otherwise distorted; venters can be examined only exceptionally and even more rarely can suture lines be observed. These conditions of preservation imposed the utmost caution in identification.

The taxonomy of Arkell *et alii* (1957) is, as a rule, followed in the present paper.

The rich ammonite faunas of the Cretaceous of Colombia have aroused the interest of paleontologists ever since the days of Alcide d'Orbigny (1840), but that interest was focused chiefly on Barremian and younger forms which are much better preserved than the pre-Barremian ones. For the previous literature bearing on the subject of the present report, reference may be made to Royo y Gomez (1945a, pp. 212–218) and Bürgl (1957, pp. 119–120).

SYSTEMATIC PALEONTOLOGY

ORDER AMMONOIDEA

SUBORDER LYTOCERATINA HYATT, 1889

SUPERFAMILY ANCYLOCERATACEAE MEEK, 1876

FAMILY ANCYLOCERATIDAE MEEK, 1876

SUBFAMILY CRIOCERATITINAE WRIGHT, 1952

PARANCYLOCERAS SPATH, 1924

?Parancyloceras sp.

Figures 1, 2

The two illustrated whorl fragments seem to be detached (or about to detach themselves) from their inner whorls which are not preserved. Therefore they are tentatively referred to the above genus. Both exhibit single, only slightly sinuous ribs, with occasional indication of bifurcation on the umbilical shoulder or of alternation of longer and shorter ones. All costae increase markedly in width towards the periphery.

A still closed but fully evolute coil (F.N.M. No. K-3017) may be conspecific with the whorl fragments just described.

LOCALITY: Area of Villa de Leiva, department of Boyacá.

AGE: Supposedly Barremian.

SUBFAMILY ANCYLOCERATINAE MEEK, 1876

LEPTOCERAS UHLIG, 1883

Leptoceras ?hubachi (Royo)

Figure 3

?Karsteniceras hubachi ROYO Y GOMEZ, 1945a, p. 224, pl. 30, fig. 2.

Non Leptoceras hubachi (Royo); BÜRGEL, 1957, p. 132, pl. 4, fig. 7.

The almost complete specimen in the shape of an open circle, measuring about 45 mm. in diameter and illustrated in figure 3, and four fragments from the same locality, two of which attain about 10 mm. in width, are clearly referable to *Leptoceras*. All these specimens

show a nearly straight, slightly oblique, transverse costation which varies in density, according to growth stage, from 14 ribs a centimeter to five ribs a centimeter.

REMARKS: Except for its larger size, this form seems to agree well with Royo's species from the Cáqueza formation. However, the form referred to the latter by Bürgl (*loc. cit. in synonym.*) is hardly conspecific; its costation is much more dense and the tube is wider. On the other hand, our figured specimen greatly resembles *L. lissoni* Rivera (1951, p. 44, pl. 4, fig. 6, pl. 5, figs. 1, 2) from the Puente Inga beds of Peru, but it increases much more slowly in width of the tube. *Leptoceras* (?*Lytocrioceras*) *sabaudianum* Pictet and de Loriol, var. *non-tuberculata* Sarkar (1955, p. 140, pl. 9, fig. 13, pl. 10, fig. 14) is somewhat similar in costation, though not in mode of coiling, but at least the specimen illustrated in Sarkar's plate 9 shows, despite the varietal name, distinct indication of two rows of tubercles of which no trace can be found in our form.

LOCALITY: Quebrada Honda, department of Boyacá. Bürgl (1957, p. 131) records a *Leptoceras* sp., which may well be conspecific, from Rio Báta, i.e., from the same area and of the same age.

AGE: Berriasian. (Rivera dates her above-mentioned species as late Tithonian or Berriasian; Royo y Gomez dates his as Valanginian.)

Leptoceras sp.

Figures 4, 5

This form is represented by a single fragment which is septate throughout and attains only 15 mm. in over-all length but is three-dimensionally preserved, a rare occurrence in the shales from which it was collected. There are eight quite strong, gently sinuous ribs to a length of 1 cm.; they attain their maximum height at their ventral ends which are directed slightly forward rather than running perpendicularly towards the median line. Between these ventral ends of the costae a narrow band remains smooth.

This is one of the few ammonites from the soft shales in which suture lines can be observed. The last one (figs. 4, 5) shows only little indentation and the following elements: a wide and shallow siphonal lobe, a rather broad external saddle, halved by a short lobule, an indistinctly trifid first lateral lobe, and a wide, bipartite lateral saddle; a second lobe and one more saddle follow between the lateral saddle and the antisiphonal lobe.

REMARKS: Except for the more dense costation, this fragment resembles the preceding form, with which it may be conspecific. Even

if it be not, the single small fragment present is not deemed a sufficient hypodigm for the establishment of a new species.

LOCALITY: East of Santa Rosa de Viterbo, department of Boyacá.

AGE: Berriasian.

***Leptoceras ubalaense*, new species**

Figure 6

?*Leptoceras hubachi* (Royo); BÜRGL, 1957, p. 132, pl. 4, fig. 7.

In addition to the holotype (fig. 6), another nearly complete specimen and several fragments were collected at the type locality.

Within the genus *Leptoceras* this species is characterized by an increase of the tube rapidly in width and by the fineness and density of the costation; 25 ribs to a centimeter are counted at an early stage and about nine at the latest observable, at which the diameter of the tube somewhat exceeds 10 mm. At that stage the ribs become slightly sinuous, turning from the inner margin obliquely backward; they are more rursiradiate than in *L. ?hubachi*.

REMARKS: This species differs from *L. ?hubachi* in the finer and more dense ornamentation and in the much faster increase of the tube in width. In both these respects I would be inclined to attach the form referred by Bürgl (*loc. cit. in synonym.*) to *L. hubachi* to the present species rather than to Royo's.

LOCALITY: Near Ubalá, department of Cundinamarca. This form seems to be represented also at two localities on the Rio Negro, department of Cundinamarca, and possibly near Villa de Leiva, department of Boyacá.

AGE: Lower Valanginian. Bürgl dates his above-mentioned form as (upper) Valanginian.

FAMILY PTYCHOCERATIDAE MEEK, 1876

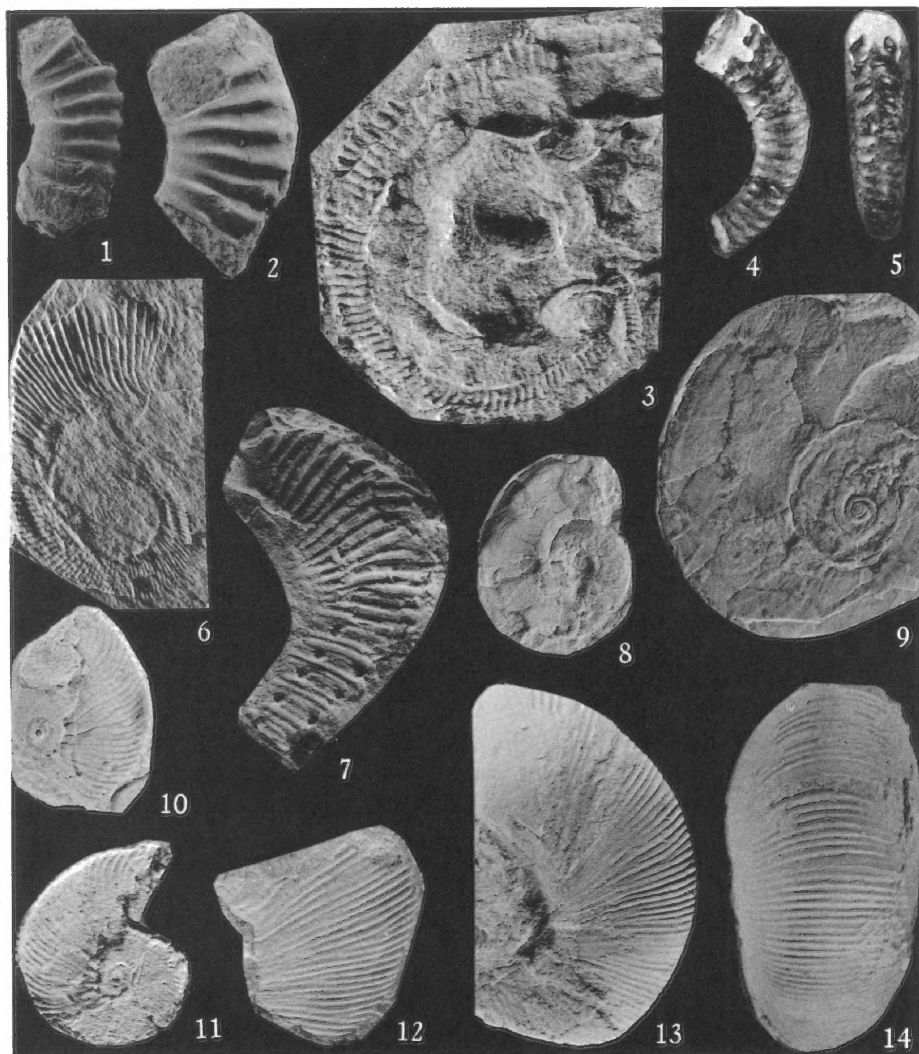
***HAMULINA* D'ORBIGNY, 1843**

?*Hamulina* sp.

Figure 7

About a dozen fragments and imprints thereof, the best of which is illustrated, seem all to belong to the same uncoiled form that has the dense costation in common with *Leptoceras ubalaense* but differs from it in being distinctly bituberculate at an early stage; also the width of the tube seems to increase faster than in any of the *Leptoceras* species from Colombia.

The costation is straight and rather stiff at an early stage, but later in development the ribs become markedly recurved at their ventral



FIGS. 1, 2. *?Parancyloceras* sp., I.P. Nos. 25177a, 25177b. $\times 1$.

FIG. 3. *Leptoceras ?hubachi* (Royo), I.P. No. 25143. $\times 1$.

FIGS. 4, 5. *L.* sp., I.P. No. 25108. $\times 2$.

FIG. 6. *L. ubalaense*, new species, holotype, I.P. No. 25126. $\times 1$.

FIG. 7. *?Hamulina* sp., I.P. No. 25166 (imprint). $\times 2$.

FIGS. 8, 9. *?Neolissoceras* sp. 8. I.P. No. 25166. $\times 1$. 9. I.P. No. 25106. $\times 2$.

FIGS. 10, 11. *Kossmatia viterboensis*, new species, holotype, I.P. No. 25164. 10. Imprint. $\times 1$.

FIGS. 12-14. *Olcostephanus delicatecostatus*, new species, 12. I.P. No. 25109A. $\times 1$. 13, 14. Holotype, I.P. No. 25116. $\times 1$.

ends. In the figured fragment the outer tubercles seem to be situated closer to the margin than the inner ones; the former disappear rather

abruptly where the shell bends, whereas the latter continue, gradually diminishing, as far as the fragment is preserved. The pairs of tubercles are separated by ribs that go straight across the fragment and are more distinct and narrower than the others which connect the tubercles of each pair; mostly there is a broader rib to which a narrower one clings.

In some of the fragments tentatively referred to this species the tubes grow almost 30 mm. wide; these fragments exhibit strong, parallel ribs which bifurcate in a few specimens only.

REMARKS: Because of the uncertainty of the generic affinities of this species, I refrain from naming it.

LOCALITY: South of Santa Rosa de Viterbo, department of Boyacá.

AGE: Hauterivian.

SUBORDER AMMONITINA HYATT, 1889

SUPERFAMILY HAPLOCERATACEAE ZITTEL, 1884

FAMILY HAPLOCERATIDAE ZITTEL, 1884

NEOLISSOCERAS SPATH, 1923

?*Neolissoceras* sp.

Figures 8, 9

Several flattened disks, the largest of which measures about 40 mm. in diameter, show a rather involute shell shape and faint, gently sigmoidal growth striae which turn decidedly forward towards the periphery where they can be seen, in only one specimen, to produce a delicate serration. Neither constrictions nor varices are recognizable in any of the specimens examined.

In one of them poorly preserved suture lines show a first lateral saddle which markedly overtops the external one—a character supporting reference of this form to *Neolissoceras*. Because the whorl section cannot be examined in these flattened disks, however, this reference must remain tentative, and I refrain from naming the species.

LOCALITY: South of Santa Rosa de Viterbo, department of Boyacá.

AGE: Hauterivian.

SUPERFAMILY PERISPHINCTACEAE STEINMANN, 1890

FAMILY PERISPHINCTIDAE STEINMANN, 1890

SUBFAMILY ATAXIOCERATINAE BUCKMAN, 1921

KOSSMATIA UHLIG, 1907

Kossmatia viterboensis, new species

Figures 10, 11

A single, slender, moderately involute disk, attaining about 25 mm.

in diameter, seems to be septate throughout. On the last quarter whorl it carries 18 thin and delicate, gently falciform ribs, the outer ends of which turn decidedly forward. Those of both sides appear to meet in an arc on the narrow venter. Some costae bifurcate in the inner zone of the flanks, others in the outer one; other secondary ribs are intercalated.

REMARKS: The shell shape and the character of the costation strongly suggest the genus *Kossmatia* and may justify the naming of a species based on a single individual, which thus becomes its holotype by monotypy.

LOCALITY: Near Santa Rosa de Viterbo, department of Boyacá.

AGE: Berriasian. Should the identification here proposed prove to be correct, it would imply extension of the stratigraphic range of the genus, given as Kimmeridgian to upper Tithonian by Arkell (1957, p. L323), into the early Cretaceous.

FAMILY OLCOSTEPHANIDAE HAUG, 1910

SUBFAMILY SPITICERATINAE SPATH, 1924

SPITICERAS UHLIG, 1903

SUBGENUS *KILIANICERAS* DJANELIDZÉ, 1922

Spiticeras (*Kilianiceras*) cf. *damesi* (Steuer)

Figure 18

Cf.

Stephanoceras Damesi STEUER, 1897, p. 67, pl. 6, figs. 1-4.

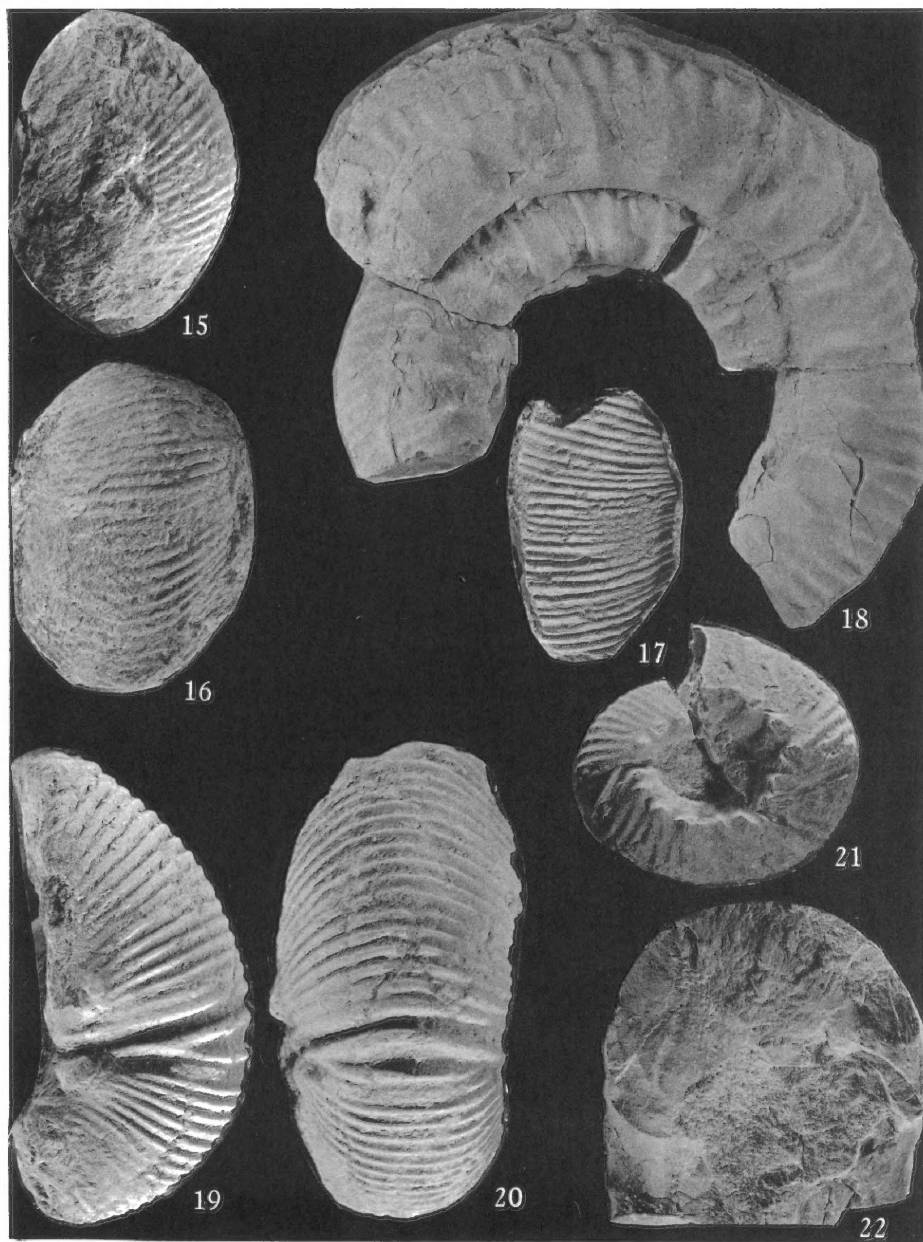
Spiticeras Damesi Steuer; GERTH, 1925, p. 66, fig. 4.

S. (Kilianiceras) damesi (Steuer); ARKELL ET AL., 1957, p. L346, non fig. 454, 1.¹

A single, incomplete, somewhat deformed, and evolute disk attains, as preserved, 170 mm. in diameter. The outer whorl carries strong, orad concave, slightly prorsiradiate ribs, about 12 of which can be counted on its anterior half; they form rather sharp, radially elongated tubercles in the inner third of the flanks. From two to three secondary ribs which are restricted to the peripheral zone of the flanks are intercalated between every two primary ones; occasionally, primary ribs bifurcate into two secondary ones. On the penultimate whorl the circumumbilical tubercles are heavier than on the outer one and rather bullate. About one-quarter of a whorl from the anterior end there is a distinct constriction which runs parallel to the primary ribs.

REMARKS: This form is comparable to the type species of the sub-

¹ This figure is certainly not a reproduction of Steuer's figure 1, as it is apparently meant to be.



FIGS. 15-17. *Olcostephanus* sp. 15, 16. I.P. No. 25116. $\times 1$. 17. I.P. No. 25109A. $\times 1$.

FIG. 18. *Spiticeras* (*Kilianiceras*) cf. *damesi* (Steuer), I.P. No. 67524. $\times 1/2$.

FIGS. 19, 20. *Subastieria* aff. *sulcosae* (Pavlow and Lamplugh), I.P. No. 25112. $\times 1$.

FIGS. 21, 22. *Olcostephanus* aff. *atherstoni* (Sharpe), I.P. Nos. 25184a, 25184b. $\times 1$.

genus, *S. (K.) damesi*, but differs from it in its less dense and heavier costation.

LOCALITY: Rio Fonce, north of Socorro, department of Santander.

AGE: Whereas *S. (K.) damesi* (and *Olcostephanus laticosta* with which it is associated in the Argentinian Cordillera) are dated as Valanginian by Gerth, a Hauterivian age is here ascribed to the present form.

SUBFAMILY OLCOSTEPHANINAE HAUG, 1910

OLCOSTEPHANUS NEUMAYR, 1875

This genus has long been known and repeatedly recorded, mostly under the invalid name "*Astieria*," from the lower Cretaceous of Colombia. It is well characterized by its evenly rounded whorl profile, which lacks any pronounced lateroventral shoulders, and by the straight or nearly straight, only slightly prorsiradiate course of its ribs all over the sides and venter. Additional features are circumumbilical tubercles, widely varying in number and heaviness, and occasional constrictions. Distinction between several species represented in the company's collections is based on thickness of the conch, coarseness or fineness and density of the costation, and characters of the circumumbilical tubercles, where observable.

Olcostephanus sp.

Figures 15-17

Under this designation several incomplete specimens and fragments, all poorly preserved, are comprised which show moderate width of the conch and a costation of medium strength and density (about 15 ribs to a quarter whorl). Just one bullate tubercle which rides on the umbilical shoulder can be observed in one of them. Constrictions can only indistinctly be recognized here and there.

REMARKS: In the character of costation this form agrees fairly well with Riedel's (1938, pl. 3, figs. 7, 8) *Astieria* sp. from the same area, but the tubercles stand farther off the umbilicus in Riedel's form.

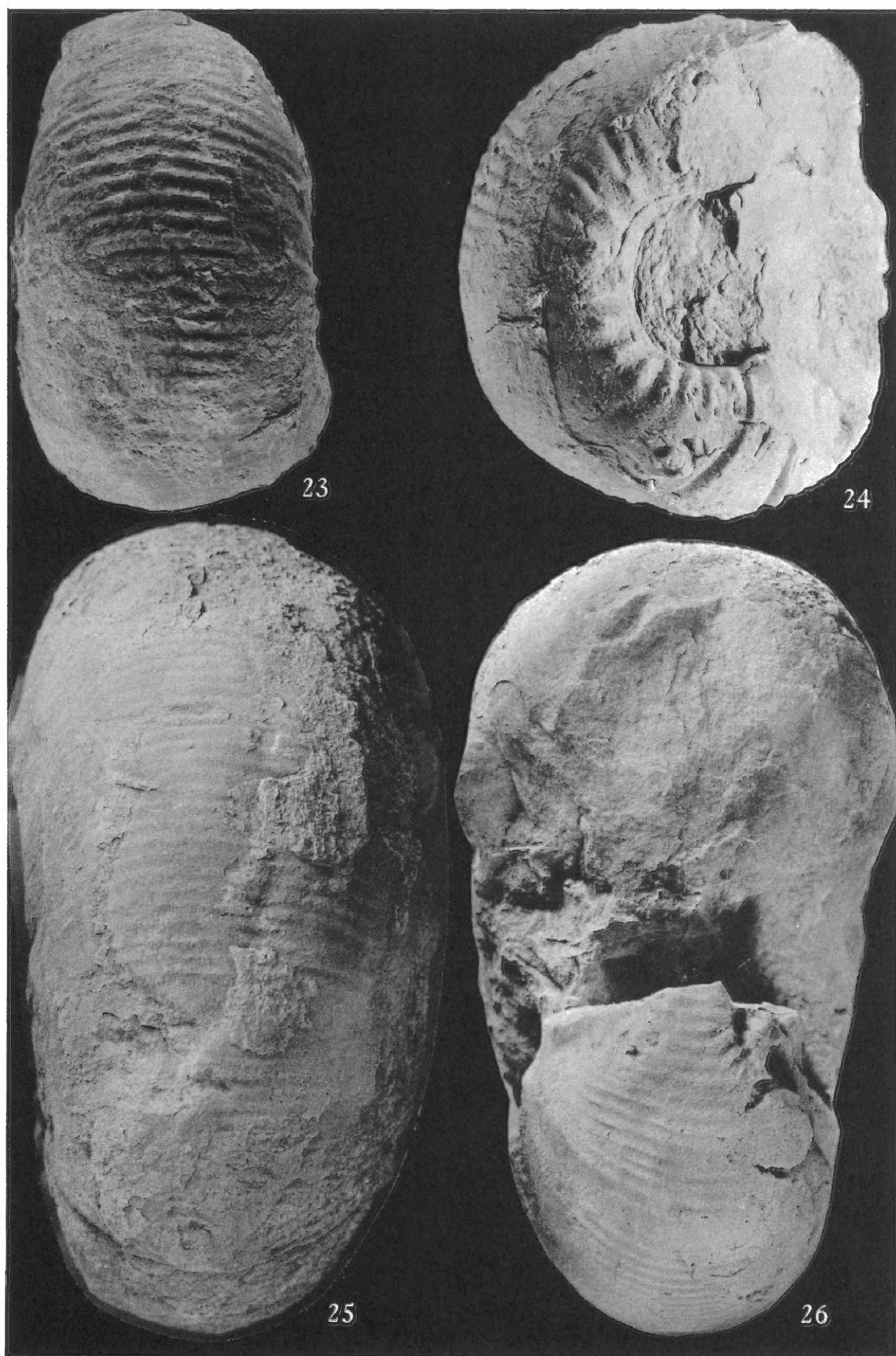
LOCALITY: On both banks of the Cáqueza River near Cáqueza, department of Cundinamarca.

AGE: Probably upper Valanginian.

Olcostephanus delicatecostatus, new species

Figures 12-14

This species is characterized by the fineness and density of the costation, there being nearly 25 ribs on a quarter whorl, as counted



FIGS. 23-26. *Olcostephanus* cf. *astierianus* (d'Orbigny). 23, 24. I.P. No. 25184. $\times 1$. 25, 26. I.P. No. 81087. $\times 1$.

along the periphery. Some ribs bifurcate at about midflanks. In one individual only three circumumbilical tubercles of medium strength are present. In the holotype, illustrated in figures 13 and 14, one or two narrow, extremely shallow constrictions are recognizable.

REMARKS: The fineness and density of the costation serve to distinguish this species from the preceding form and, even better, from the following ones. The costation is even finer and more dense than in the type species, *O. astierianus* (d'Orbigny), but the fragment illustrated in our figure 12 strikingly resembles in its ribbing the original of d'Orbigny's (1840-1842, pl. 28) figure 4 which is described by that author as a more densely ribbed variety of *O. astierianus*.

LOCALITIES: On both banks of the Cáqueza River near Cáqueza, department of Cundinamarca, perhaps also at the Rio Fonce, north of Socorro, department of Santander.

AGE: Upper Valanginian.

Olcostephanus cf. *astierianus* (d'Orbigny)

Figures 23-26

Cf.

Ammonites astierianus D'ORBIGNY, 1840-1842, p. 115, pl. 28.

Astieria astieri RIEDEL, 1938, p. 12, pl. 3, figs. 3, 4, pl. 12, fig. 2.

Astieria astieri (d'Orbigny); ROYO Y GOMEZ, 1945a, p. 232.

?*Olcostephanus astierianus* (d'Orbigny); BÜRGEL, 1957, p. 132, pl. 4, fig. 6.

This form is characterized by considerable width of the whorl profile, by a costation of medium strength and density (about 20 ribs to a quarter whorl), by closely set, radially elongated circumumbilical tubercles, of which about 15 are counted per half whorl, and by three or more not wide but sharply defined constrictions per volution; they cross the venter in a forward-directed arc which is markedly more convex than that formed by the ribs.

REMARKS: This form is markedly stouter than the true *O. astierianus*¹ but agrees well in this respect with Riedel's (*loc. cit. in synonym.*) Colombian form in which, however, the circumumbilical tubercles are more widely spaced. The specimen from Cáqueza illustrated by Bürgel, though not quite so stout, may well be conspecific with our form.

LOCALITIES: Rio Fonce, north of Socorro, department of Santander; probably also northeast of Utica, department of Cundinamarca.

AGE: Lower Hauterivian.

¹ The shell of which the whorl profile is illustrated in d'Orbigny's figure 3, ascribed by him to a female, is believed to belong to another species.

Olcostephanus bösei (Riedel)

Figures 27, 28

Astieria bösei RIEDEL, 1938, p. 10, pl. 3, figs. 1, 2, pl. 12, fig. 1.*Astieria boesei* Riedel; ROYO Y GOMEZ, 1945a, p. 232.*Olcostephanus bösei* Riedel; BÜRGL, 1957, p. 132, pl. 4, fig. 4.

The illustrated specimen and another from the same locality differ from the preceding form in being much more slender and in having only inconspicuous circumumbilical tubercles.

LOCALITY: Near Cáqueza, department of Cundinamarca.

AGE: Valanginian or lower Hauterivian.

Olcostephanus aff. *atherstoni* (Sharpe)

Figures 21, 22

Astieria aff. *atherstoni* Sharpe; RIEDEL, 1938, p. 13, pl. 3, figs. 5, 6, pl. 12, fig. 3.

This form, markedly stouter than *O. cf. astierianus*, is characterized by a well-rounded, subcircular whorl profile, by strong ribs, 25 of which are counted on half a whorl, and by sharply pointed but comparatively small circumumbilical tubercles, of which 16 are present on the outer volution of the *Scaphites*-like, deformed specimen illustrated in figure 21. It also shows three forward convex constrictions.

REMARKS: This form is believed to be conspecific with Riedel's (*loc. cit. in synonym.*) from "Cáqueza-Quetame," quoted by Bürgl (1957, p. 132).

LOCALITY: Rio Fonce, north of Socorro, department of Santander.

AGE: Lower Hauterivian.

Olcostephanus cf. *laticosta* (Gerth)

Figures 29, 30

Cf. *Astieria laticosta* GERTH, 1925, p. 62, pl. 2, figs. 8, 8a.

A reniform whorl profile, a robust costation consisting of from 20 to 25 ribs per half whorl, and quite heavy, bullate, circumumbilical tubercles, eight of which are counted on half of a whorl (fig. 30), are considered the distinctive characters of this form. The only uncrushed shell shows two or three constrictions on the outer volution.

REMARKS: This form resembles Gerth's Argentinian species but is more narrowly umbilicate and its ribs are straighter and more pronounced on the inner flanks. *Rogersites ?boussingaultii* (d'Orbigny) in Bürgl (1957, p. 132, pl. 4, fig. 3) has similarly heavy, though more widely spaced circumumbilical tubercles but differs in having a flattened venter and more pronounced lateroventral shoulders.



FIGS. 27, 28. *Olcostephanus bösei* (Riedel), I.P. No. 64051. $\times 1$.

FIGS. 29, 30. *O. cf. laticosta* Gerth, I.P. Nos. 25183b, 25183a. $\times 1$.

LOCALITY: North of Socorro, department of Santander.

AGE: Upper Hauterivian.

SUBASTIERIA SPATH, 1923

Following Wright (*in* Arkell *et al.*, 1957), I here grant *Subastieria* full generic rank, whereas Bürgl (1957, p. 132) treats it merely as a subgenus of *Olcostephanus*.

Subastieria aff. *sulcosae* (Pavlow and Lamplugh)

Figures 19, 20

Aff. *Olcostephanus sulcosus* PAVLOW AND LAMPLUGH, 1892, p. 499, pl. 18, fig. 18.

?*Holoptychites* cf. *neuquensis* (Douv.); ROYO Y GOMEZ, 1945a, p. 233.

Olcostephanus (*Subastieria*) aff. *sulcosus* (Pavlow and Lamplugh); BÜRGL, 1957, p. 132, pl. 4, fig. 5.

A fragment representing somewhat less than half of a whorl exhibits nearly 20 strong, straight ribs and three heavy, bullate, circumumbilical tubercles, which sit just above the umbilical shoulder, per quarter whorl and a wide and deep constriction, divided in two by a varix-like strong rib which forms a shallowly forward-convex tongue on the venter. A similarly strong rib, running parallel to the one just mentioned, bounds the anterior branch of that constriction orad, while the posterior branch is subdivided by a secondary rib that branches off, at the anterior third of the flanks, from the varix-like one.

REMARKS: This fragment is obviously conspecific with the form recorded and illustrated by Bürgl (*loc. cit. in synon.*) from the Cáqueza area and found by him also near Villa de Leiva.¹ The true *O. sulcosus* Pavlow and Lamplugh (*loc. cit. in synon.*) seems, however, to be more evolute and sturdier than the present form and to carry less heavy and more closely set circumumbilical tubercles. The form described by Royo y Gomez (1945a, p. 233) from the Rio Guavio, Gachalá, to judge by that author's description, may be identical with, or at least closely related to, the present one.

This form differs from *Olcostephanus astierianus* and *O. bösei* in being more involute, in its heavier costation, and in its fewer, heavier, and more bullate tubercles, from *O. astierianus*, in addition, by being less thick, from Riedel's "*Astieria* sp.," quoted above (p. 9), also in having fewer and heavier tubercles, from *O. aff. atherstoni* also in being more slender, and from *O. sp.* in its more robust costation.

¹ The specimen from Villa de Leiva was originally recorded by Bürgl (1954, p. 12) under the name *Polyptychites polyptychus* Keyserling, but in a written communication, dated September 7, 1956, he changed that identification to read *Olcostephanus* (*Subastieria*) aff. *sulcosus* Pavlow and Lamplugh, and added that this form is known in very fine specimens from the Hauterivian of Cáqueza.

LOCALITIES: The illustrated fragment is from near Cáqueza, department of Cundinamarca. Bürgl records this form from the same locality and from Quetame, in the same department, and also from the area of Villa de Leiva, department of Boyacá.

AGE: The specimen from Leiva is believed to be late Valanginian in age, the one from Quetame is dated Valanginian and Hauterivian by Bürgl, and the specimens from the Cáqueza area are most probably Hauterivian.

FAMILY BERRIASSELLIDAE SPATH, 1922
SUBFAMILY BERRIASSELLINAE SPATH, 1922
BERRIASELLA UHLIG, 1905

Berriasella forma juv.

Figures 31, 32

A single, rather involute disk (fig. 31) measuring about 20 mm. in diameter, with very dense (16 to 18 ribs per quarter whorl), fine, and rather stiff costation, is believed to be a juvenile of this genus. The imprint of a considerably larger disk shown in figure 32 is probably conspecific.

REMARKS: The latter specimen somewhat resembles Bürgl's (1957, p. 131, pl. 2, fig. 4) *B. aff. delphinensis* (Kilian), but the costation is markedly finer than in Bürgl's form.

LOCALITY: Gachalá-Ubalá area, department of Cundinamarca.

AGE: Upper Berriasian to lower Valanginian.

Berriasella sp. 1

Figure 33

A single flattened fragment is illustrated for exhibiting the ventral region of a medium-sized individual. Its median portion constitutes a smooth band; the ventral ends of the ribs from both sides point perpendicularly towards the median line, not diagonally forward as in the genus *Sarasinella*. This fragment is therefore believed to belong to *Berriasella*.

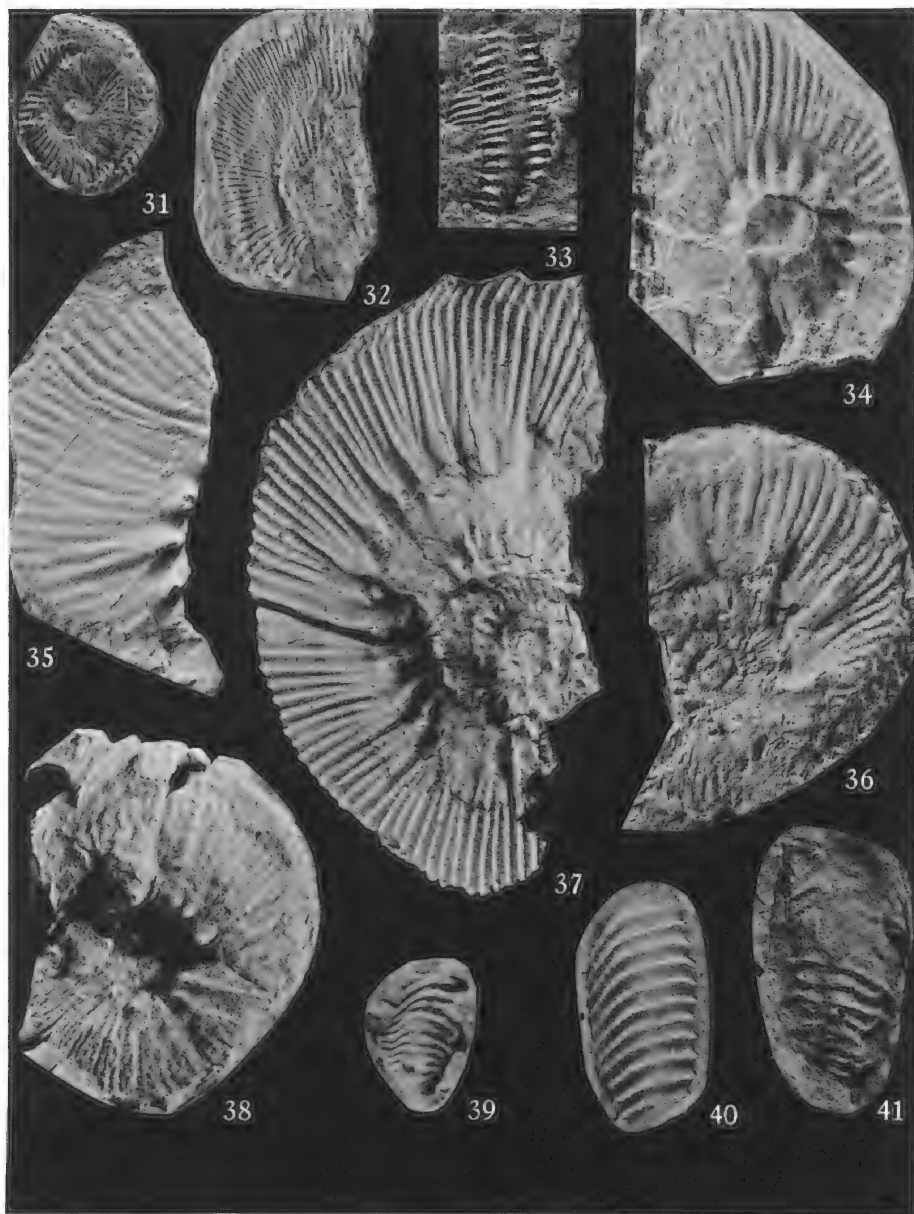
LOCALITY: Near Gachalá, department of Cundinamarca.

AGE: Upper Berriasian.

Berriasella sp. 2

Figures 34-36

An incomplete whorl measuring about 50 mm. in diameter (fig. 34) and a flattened fragment of a somewhat larger whorl (fig. 35) stand out among the forms of this genus discussed in the present report by



FIGS. 31, 32. *Berriasella* forma juv., I.P. Nos. 25125, 25104. $\times 1$.

FIG. 33. *B.* sp. 1, I.P. No. 25125. $\times 1$.

FIGS. 34, 35. *B.* sp. 2, I.P. Nos. 25125a, 25125b. $\times 1$.

FIG. 36. *B.* sp. 2 ?var., I.P. No. 20175. $\times 1$.

FIGS. 37, 38. *B. colombiana*, new species. 37. Holotype, I.P. No. 25126. $\times 1$.
38. I.P. No. 25157. $\times 1$.

FIGS. 39-41. *Substeuerocheras mutabile*, new species, I.P. Nos. 74230b, 9997d, 25145a. $\times 1$.

carrying radially compressed circumumbilical tubercles which move closer to the umbilical shoulder and become more radially elongated towards the aperture. Two or three ribs radiate from each of these tubercles; some of these ribs bifurcate once more. All costae run in a gentle, forward concave arc across the flanks.

Figure 36 illustrates what is believed to be a variety of this form with fewer circumumbilical tubercles.

REMARK: Although this form appears to be well characterized by its ornamentation, the specimens available are too poorly preserved to justify the naming of a new species.

LOCALITIES: Near Gachalá, probably also near Quetame, both in the department of Cundinamarca.

AGE: Upper Berriasian.

***Berriasella colombiana*, new species**

Figures 37, 38

The description of this species is based on the holotype (fig. 37) which measures about 75 mm. in diameter. Several smaller disks, interpreted as juveniles of this species, and some whorl fragments referred to it were also collected.

The excellently preserved outer whorl of the holotype and parts of the penultimate and antepenultimate whorls can be examined. The conch is rather involute. The flanks are gently convex. The outer volution exhibits a single constriction (occasionally constrictions occur in this genus; Mazenot, 1939, p. 31). Most conspicuous are strong, radially elongated, circumumbilical tubercles, from each of which from four to five ribs originate, mostly in such a way that two short stumps, radiating from those tubercles, split almost immediately into two ribs each. The costation is dense (55 ribs on the anterior half of the outer whorl, as counted along the periphery), stiff, and radial. The individual ribs are well defined, narrow, and straight. Only in the anteriormost part of the volution do their outer ends form a forwardly directed hook. On the two preceding whorls the individual ribs seem to be comparatively stronger, but the circumumbilical tubercles less pronounced.

A disk not quite attaining 45 mm. in diameter (fig. 38) exhibits circumumbilical tubercles that are not radially elongated but rather pointed, and the ribs cease, in the anteriormost quarter whorl, to be so distinctly bundled as in the holotype, with single secondary ribs more frequently intercalated between those originating by the bifurcation of primary ones. Similar differences can, however, be noted between

the penultimate and last volutions of the holotype also. Therefore the smaller disk is, on the strength of its stiff and dense costation (37 ribs on half of a whorl) and of the presence of circumumbilical tubercles at the inner ends of all primary ribs, also referred to this species.

REMARKS: The ornamentational features described above clearly distinguish this species from its congeners discussed in the present report. Some *Berriasella* species illustrated by Mazenot (1939) somewhat resemble *B. colombiana* but none of them to an extent to suggest conspecificity.

On the other hand, our form somewhat resembles *B. callistoides* Rivera (1951, p. 30, pl. 4, fig. 1) *non* Behrendsen, but the Peruvian form has a less stiff and less dense costation and lacks the present form's conspicuous tubercles. The true *B. callistoides* Behrendsen [1891 (1891-1892, vol. 43), p. 402, pl. 23, fig. 1; Mazenot, 1939, pl. 7, fig. 1; Leanza, 1945, p. 41, pl. 5, figs. 5, 6], made by Spath (1923) the type species of *Parodontoceras* and assigned a Tithonian age by Leanza (1947, p. 837), with its strongly sinuous ribs which bifurcate only at the outer third of the flanks, is much less similar to the present species. Hence the latter is not referred to *Parodontoceras* but left with *Berriasella*.

How the *B. (Parodontoceras)* aff. *callistoides* (Behrendsen) listed by Bürgl (1957, p. 131) from the Tithonian of the Cáquesa-Quetame area compares with *B. colombiana* cannot be decided in the absence of illustrations. However, its dating as Tithonian would, as such, not exclude conspecificity, for other forms assigned that age by Bürgl are also considered Berriasian, or even Valanginian, in the present report.

LOCALITIES: Gachalá-Ubalá area, department of Cundinamarca; also north of Pajarito, department of Boyacá.

AGE: Valanginian.

Berriasella sp. 3

Figure 46

An incomplete and somewhat deformed but three-dimensionally preserved shell measuring a little more than 60 mm. in diameter is characterized by straight, broad, fold-like, and somewhat prorsiradiate ribs which cross the venter uninterruptedly. About 30 are counted per half whorl along the periphery. The inner zone of the flanks is nowhere well preserved. In one place only bifurcation of ribs occurs in the middle of the flanks. The lateroventral shoulders appear to be rounded.

REMARKS: Despite the similarity in costation, this form is not be-



FIG. 42. ?*Subalpinites* cf. *quadripartitus* (Steuer), I.P. No. 9989. $\times 1$.

FIG. 43. ?*S.* sp. 2, I.P. No. 25125a (imprint). $\times 1$.

FIG. 44. ?*S.* sp. 1, I.P. No. 25143a. $\times 1$.

FIG. 45. *Substeueroceras mutabile*, new species, I.P. No. 25145b. $\times 1$.

FIG. 46. *Berriasella* sp. 3, I.P. No. 25108. $\times 1$.

lieved to belong to the genus *Thurmanniceras* the venter of which is truncate. It resembles indeed some of the many species of *Berriasella*

illustrated by Mazenot (1939), e.g., *B. berthei* (Toucas) (pl. 2, fig. 11), *B. discrepans* (Retowski) (pl. 20, fig. 6b), and *B. grandis* Mazenot (pl. 22, fig. 3). From the other *Berriasella* species dealt with in the present report this form clearly differs in the width and bluntness of the ribs.

LOCALITY: East of Santa Rosa de Viterbo, department of Boyacá.

AGE: Berriasian.

SUBALPINITES MAZENOT, 1939

Following Arkell and his co-authors (1957, p. L352) I grant full generic rank to this taxon which might perhaps better be considered merely as a subgenus of *Berriasella*. All three forms dealt with under the above heading can, however, only tentatively be referred to *Subalpinites*.

?Subalpinites cf. quadripartitus (Steuer)

Figure 42

Cf. *Hoplites quadripartitus* STEUER, 1897, p. 60, pl. 19, figs. 4, 6.

A single specimen in the company's collections is characterized by heavy costation which consists of ribs much broader than the intercostals; the costae bifurcate at midflanks, the point of bifurcation being accentuated by a strong, radially elongated tubercle. Twenty-four ribs are counted along the periphery of the last half whorl; their outer portions assume a somewhat club-like aspect towards the anterior end.

REMARKS: This form differs from true *?S. quadripartitus* (Steuer) only in having a narrower umbilicus. Steuer's species was referred by Gerth (1925, p. 100) to *Acanthodiscus* but by Mazenot tentatively to his genus *Subalpinites*.

LOCALITY: Gachetá-Gachalá area, department of Cundinamarca.

AGE: Upper Berriasian.

?Subalpinites sp. 1

Figure 44

By its heavy, broad, somewhat swollen primary ribs that bifurcate or trifurcate in the middle of the flanks this species is strongly reminiscent of the preceding form and is therefore also tentatively referred to *Subalpinites*. One of the specimens here included (fig. 44) shows an indication of a row of tubercles immediately beneath the latero-ventral one. Another clearly exhibits a long and narrow lateral lappet.

REMARKS: Preservation of the four individuals referred to this species is much too poor to justify its being named.

LOCALITY: Quebrada Honda, department of Boyacá.

AGE: Upper Berriasian.

?Subalpinites sp. 2

Figure 43

Two disks and imprints thereof, the diameter of which may have measured 80 to 100 mm. before distortion, and two fragments of much larger disks strongly resemble *?Subalpinites* sp. 1 in shell shape and in the character of the costation, but they carry quite heavy circum-umbilical tubercles, in addition to the outer ones, and, at least in portions of the conch, also somewhat less heavy tubercles in the middle of the flanks.

REMARKS: This form is therefore considered to be a separate species which is, however, not named because of the poor preservation of the material available.

LOCALITY: Near Gachalá, department of Cundinamarca.

AGE: Upper Berriasian.

SUBSTEUROCERAS SPATH, 1922

Substeuerocheras mutabile, new species

Figures 39-41, 45, 47-51

? *Thurmannites* (*Kilianella*) cf. *lucensis* (Sayn); ROYO Y GOMEZ, 1945a, p. 228, pl. 30, fig. 1a.

? *Thurmannites thurmanni* (Pictet et Camp.); ROYO Y GOMEZ, 1945a, p. 227, fig. 4, pl. 31, fig. 1.

? *Thurmannites ?duraznensis* (Gerth); ROYO Y GOMEZ, 1945a, p. 227, fig. 5, pl. 31, fig. 2.

? *Substeuerocheras* aff. *lamellicostatum* (Burckhardt); BÜRGEL, 1957, p. 131, pl. 2, unnumbered figure at upper left.

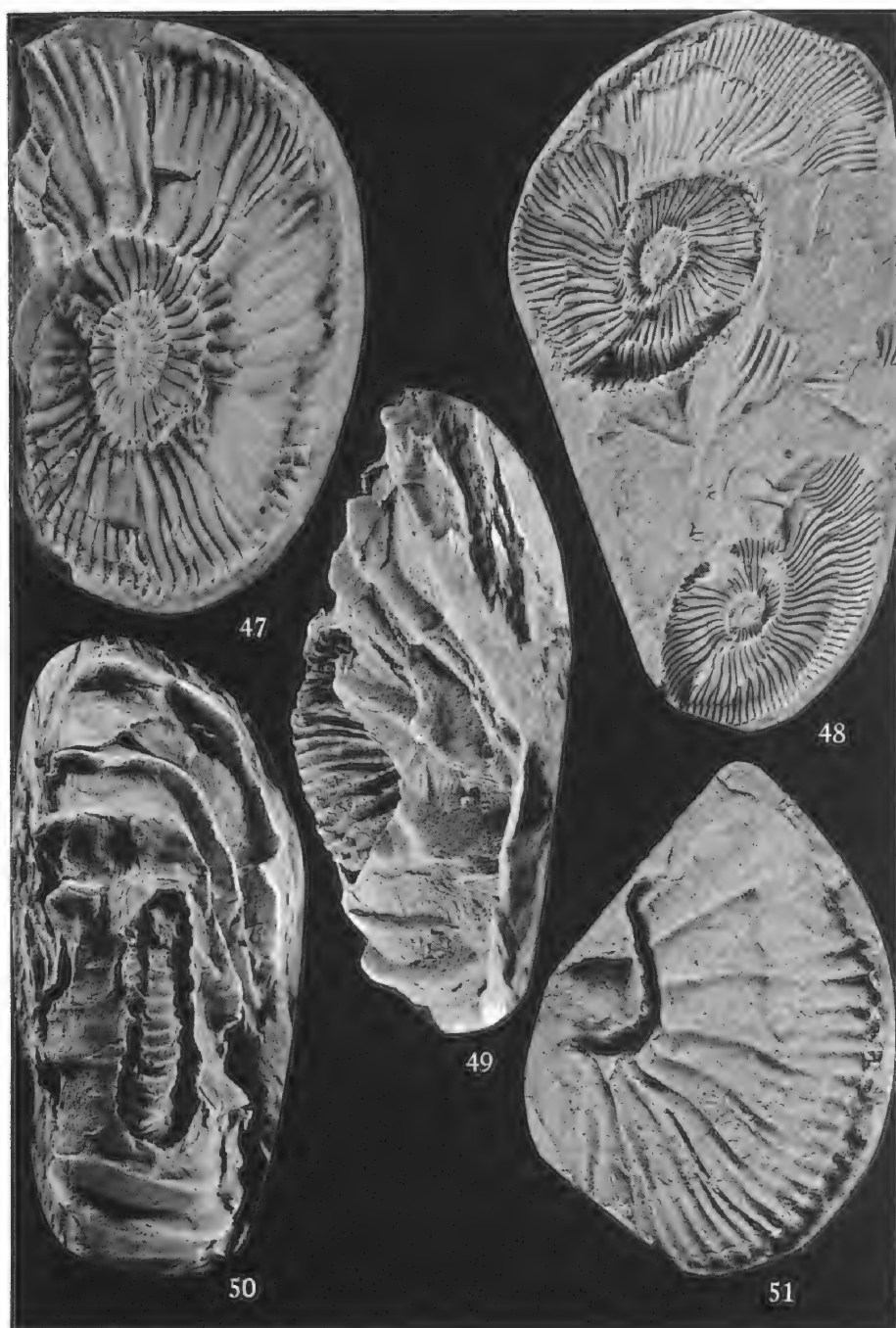
? *Thurmanniceras* cf. *duraznense* Gerth; BÜRGEL, 1957, p. 131, pl. 2, unnumbered figure at upper right.

? *Neocomites* (*Cuyanicerias*) cf. *transgrediens* (Steuer); BÜRGEL, 1957, p. 131, pl. 2, fig. 5.

? *Berriasella* aff. *delphinensis* (Kilian); BÜRGEL, 1957, p. 131, pl. 2, fig. 6.

This species is characterized by, and its name alludes to, the profound changes that occur in the course of its ontogeny; various growth stages of it, if they cannot be connected morphologically, could readily be mistaken for different species, if not genera.

Most commonly the early stages are encountered (figs. 39, 40, 48; Royo y Gomez, 1945a, pl. 31, fig. 1; Bürgel, 1957, unnumbered figure at upper right of pl. 2, illustrating the same specimens as Royo's figure, and pl. 2, figs. 5, 5b). These early stages are characterized by



FIGS. 47-51. *Substeuerocheras mutabile*, new species. 47, 48, I.P. Nos. 9997c, 9997a, 9997b (imprints). $\times 1$. 49, 50. Holotype, I.P. No. 25147. $\times 1$. 51. I.P. No. 74230a. $\times 2$.

crowded (up to 35 per quarter whorl, counted around the periphery), thin, rather high and sharp, gently sigmoidal ribs; about half of that number are primary ribs which bifurcate at about the middle of the flanks. Both shells shown in our figure 48 are preserved to the apertural margin, from which a rather long, spoon-shaped, lateral lappet extends. A fragment of a venter from the same locality (fig. 40) shows the sharp ribs crossing the venter uninterruptedly and horizontally, just as they do in a similar fragment illustrated in Royo's figure 1, reproduced by Bürgl, but they are, especially in the posterior part of our fragment, slightly higher on the shoulders than along the median line. In the anterior part of the venter seen in Royo's and Bürgl's above-quoted figures the ribs just begin to be interrupted along the median line.

Somewhat later in the ontogeny the primary ribs step farther apart quite abruptly, allowing for the insertion of up to four secondary ribs between them (fig. 51). In the specimen shown in this figure, and in two whorl fragments that are illustrated in figures 39 and 41, the passage of the ribs across the lateroventral shoulders can well be seen. In some individuals representing a somewhat later developmental stage, e.g., in the peculiarly crushed fragment illustrated in figure 45, the primary ribs appear to be reduced to sharp, radially compressed, circumumbilical tubercles which stand even farther apart than the anteriormost ribs seen in figure 51 and which split into three or four ribs each, with more ribs intercalated.

The latest stage present is represented by the fragment illustrated in figures 49 and 50. It could hardly be recognized as a *Substeueroceras* were it not for the fact that the antepenultimate whorl is visible through a hole in the penultimate and outer whorls. In side view the primary ribs of the last show the same sharp, radially compressed tubercles as seen in figure 45. They give rise to two secondary ribs each; however, all ribs have become very coarse and heavy and stand far apart, also on the venter where some of them are clearly lower in the middle than on the shoulders. For exhibiting so markedly the profound ontogenetic changes alluded to in the specific name, this specimen is designated the holotype of *S. mutabile*, despite its fragmentary condition.

REMARKS: This form is certainly congeneric with, and closely related to, *S. koeneni* (Steuer, 1897, p. 45, pl. 17, figs. 1-3; Gerth, 1925, p. 83, pl. 6, fig. 6; Leanza, 1945, p. 28, fig. 2, pl. 5, figs. 7, 8, pl. 7, fig. 4) from Argentina and to the Peruvian form referred to Steuer's species



FIG. 52. *Substeueroceras permulticostatum* (Steuer), I.P. No. 25143. $\times 1$.

FIGS. 53, 55. ?*Raimondiceras* sp., I.P. No. 47826. $\times 1/2$.

FIGS. 54, 56–59, 61, 62. *Thurmanniceras santaros anum*, new species. 54. I.P. No. 66294. $\times 2$. 56. I.P. No. 25106c. $\times 1$. 57. Holotype, I.P. No. 25106b. $\times 1$. 58, 59. I.P. No. 25182 (59, imprint). $\times 2$. 61. I.P. No. 25180b. $\times 2$. 62. I.P. No. 25180a (anterior part of whorl shown as imprint). $\times 2$.

FIG. 60. *T.* sp. 2, I.P. No. 25176 (imprint). $\times 2$.

by Rivera (1951, p. 34, pl. 3, fig. 2), as well as to *S. lamellicostatum* (Burckhardt, 1912, p. 167, pl. 11, figs. 1-4, 6) from Mexico, but both those species maintain the juvenile character of the costation up to diameters of about 12 cm. and 9 cm., respectively, without undergoing the striking sculptural changes described above which are considered characteristic of the Colombian species. However, the several specimens recorded from the Quebrada Honda and Gachalá areas by Royo y Gomez and Bürgl (*loc. cit. in synonym.*) under several generic names are believed to represent the various ornamental stages of this species, especially as they are from the same areas that have also yielded the specimens dealt with here.

LOCALITIES: Quebrada Honda, department of Boyacá, and near Gachalá, department of Cundinamarca.

AGE: Burckhardt (*loc. cit.*) places the Mexican "Couches a *Steuero-ceras*" which have yielded his *S. lamellicostatum* at the Jurassic-Cretaceous boundary. Leanza (1947, p. 840) correlates the *Substeuero-ceras*-bearing horizons of Argentina and Mexico with a level between the *transitorius* zone and the *boissieri* zone and places the *Substeuero-ceras* beds at the very top of the Tithonian stage. Rivera (1951, p. 16) assigns to her *S. koeneni* an age not older than latest Tithonian and not younger than Berriasian. Perhaps influenced by Leanza, Bürgl dates the forms here tentatively included in the synonymy of the present species as upper Tithonian, whereas Royo y Gomez seems to be inclined to assign them a Valanginian age. On the strength of my stratigraphic observations in the field, however, I consider the beds with *S. mutabile* early Berriasian rather than late Tithonian in age.

Substeuero-ceras permulticostatum (Steuer)

Figure 52

Odontoceras permulticostatum STEUER, 1897, p. 56, pl. 23, figs. 1, 2.

Steuero-ceras permulticostatum (Steuer); GERTH, 1925, p. 85.

Substeuero-ceras permulticostatum Steuer; RIVERA, 1951, p. 35, pl. 3, figs. 3, 5.

This species differs from *S. colombianum* in its finer and more regular costation which maintains the same fineness and density throughout the outer whorls of the two specimens examined. It should be noted, however, that the ontogeny cannot be followed beyond a diameter of about 45 mm. The ribs bifurcate or trifurcate only occasionally.

LOCALITY: Quebrada Honda, department of Boyacá.

AGE: Upper Berriasian.

RAIMONDICERAS SPATH, 1924*?Raimondiceras* sp.

Figures 53, 55

A large half whorl in the company's collections, attaining about 180 mm. in diameter, is characterized by a slender-elliptical whorl profile and by its ornamentation. Rather weak ribs run all over the flanks in a forward concave arc and cross the venter in a sharp, forward-pointing tongue, splitting in two. There are no tubercles. The absence of ornamentation from the anterior two-thirds of this half whorl may be due to corrosion only.

REMARKS: The ornamental features just described are found in *Hoplites raimondi* Gabb in Lisson (1907, pl. 5, figs. 1, 2), a species on which Spath based his genus *Raimondiceras*. This form is therefore, though doubtfully, referred to that genus. Its slenderness and peculiarities of ornamentation serve readily to distinguish it from *Acanthodiscus* cf. *radiatus* (see below).

LOCALITY: San Vicente-Zapatoca area, department of Santander.

AGE: ?Barremian.

SUBFAMILY NEOCOMITINAE SPATH, 1924

THURMANNICERAS COSSMANN, 1901 (= *THURMANNITES*

KILIAN AND REBOUL, 1914)

Thurmanniceras santaros anum, new species

Figures 54, 56-59, 61-65, 67

The usual aspect of flattened shells of this species, as found in the shales, is best illustrated by figures 58, 59, and 62 for juveniles and by figure 57, depicting the holotype, for somewhat larger individuals. It is characterized by its stiff, radial costation which is very dense on the innermost whorls; some ribs are single, others bifurcate, mostly at the inner third of the flanks. In a small shell, crushed in such an unusual way as to exhibit frontal and ventral views (figs. 63, 65), the ribs can be seen to be still interrupted in the posterior part of the outer whorl, with the outer ends of some forming transversely compressed tubercles, but in the anterior part of this whorl the ribs cross the venter without interruption, as they do in a somewhat larger shell shown in oblique-ventral view (fig. 56). The aforementioned median interruption of the costae can be seen even better in a three-dimensionally preserved small specimen from another locality (fig. 54); here all ribs are tuberculate.

At a later ontogenetic stage the outer ends of the ribs seem to turn forward, and in the whorl fragment illustrated in figure 61 their outer



FIGS. 63, 65, 67. *Thurmanniceras santaros anum*, new species. 63, 65. I.P. No. 25106a. $\times 2$. 67. F.N.M. No. K-3072. $\times 1$.

FIG. 64. *T. santaros anum*, new species, var., F.N.M. No. K-3043. $\times 2$.

FIG. 66. *T. sp. 2*, I.P. No. 25106. $\times 2$.

portions become thick and high, with one rib carrying a tubercle midflanks. At an even larger size, corresponding to a diameter of from 15 to 20 cm., as represented by the whorl fragment shown in figure 67, the costation assumes still another aspect; here the ribs describe a shallow forward convex arc in the inner half of the flanks and become straight, flat, and club-shaped in the outer.

Aside from these differences, ascribed to ontogenetic changes, there is otherwise considerable variation as to the degree of involution and as to the density, strength, and stiffness of costation. Thus the small disk illustrated in figure 64 exhibits a costation so much finer and more dense than in other individuals of the same size that it may be considered to represent a separate variety, if not another species.

LOCALITIES: Quite common south of Santa Rosa de Viterbo and in Villa de Leiva area, both localities in the department of Boyacá.

AGE: Hauterivian.

Thurmanniceras sp. 1

Figure 68

This species, represented at one of the outcrops of the area only by specimens too poorly preserved to justify a new specific name, has the straight and more or less radial costation in common with *T. santarosani*, but the ribs are much broader and heavier. The primary ribs carry heavy circumumbilical tubercles, and in a large fragment from this locality all ribs can be seen to end in lateroventral tubercles which point diagonally forward.

LOCALITY: South of Santa Rosa de Viterbo, department of Boyacá.

AGE: Hauterivian.

Thurmanniceras sp. 2

Figures 60, 66

This form shares the general character of the ornamentation with *T. santarosani* but is much more evolute. At one outcrop it is represented by the elliptically distorted imprint of a juvenile with a very fine and dense costation (fig. 60); at another, by a whorl fragment corresponding to a diameter of about 35 mm. (fig. 66). In the former individual some bifurcation of ribs can be recognized; in the latter stronger primary and thinner secondary costae alternate, with bifurcation taking place only exceptionally.

LOCALITIES: South of Santa Rosa de Viterbo and in the Villa de Leiva area, both these localities in the department of Boyacá.

AGE: Hauterivian.

FAVRELLA R. DOUVILLÉ, 1909

Favrella colombiana, new species

Figures 69–74, 76–79

The shell is moderately evolute, the whorl profile elliptical to inverted heart-shaped, with only gently convex flanks and rounded venter. Up to a diameter of about 30 mm. the venter is truncate or even shallowly sunk, but this median groove disappears quite abruptly (fig. 73). In a fragment corresponding to a diameter of about 75 mm. (figs. 71, 72) nine primary ribs per quarter whorl can be counted around the umbilicus and altogether 19 ribs around the periphery. At about the middle of the flanks some ribs bifurcate or trifurcate, with the points of splitting slightly raised so as to form radially compressed tubercles which are, however, not conspicuous. As a rule, single ribs are inserted between such bundles of two and three. At the aforementioned early stage the ribs end on the lateroventral shoulders in small, blunt tubercles. Soon, however, the costae from both sides become connected across the venter on which they form a chevron which becomes more pointed with growth, as is observable in the holotype (fig. 77) and in a large whorl fragment (fig. 79). In the course of development the ribs become ever more distinctly sigmoidal (figs. 69, 72, 76, 78). Density of costation also seems to increase in maturity, but a rib count yields no more than 40 on the anterior half whorl of the holotype, which is the largest disk present, as compared to 19 per quarter whorl in the fragment illustrated in figures 71 and 72. Differences in density of costation can also be found between individuals of the same size.

The short whorl fragment shown in figure 74 exhibits well the outlines of a first lateral lobe and of the adjacent saddles; although coarsened by corrosion, they agree fairly well with Favre's (1908, p. 614, fig. 1) drawings of a suture line of the genotype, *F. americana*, as do some portions of the sutures just perceptible in another, otherwise poorly preserved shell.

REMARKS: In side view the genus *Favrella* somewhat resembles the markedly older *Blanfordiceras* Spath, but in the latter genus the ribs do not, even in maturity, form the chevrons characteristic of *F. americana* (Favre, 1908, p. 613, pl. 32, figs. 11–14, pl. 33, figs. 1–4), *F. angulatiformis* [Behrendsen, 1892 (1891–1892, vol. 44), p. 16, pl. 4, fig. 2], and other species included in *Favrella* by R. Douvillé (1909). The presence of this character in the present species clearly refers it to this genus. Within the genus, however, it can be identified neither

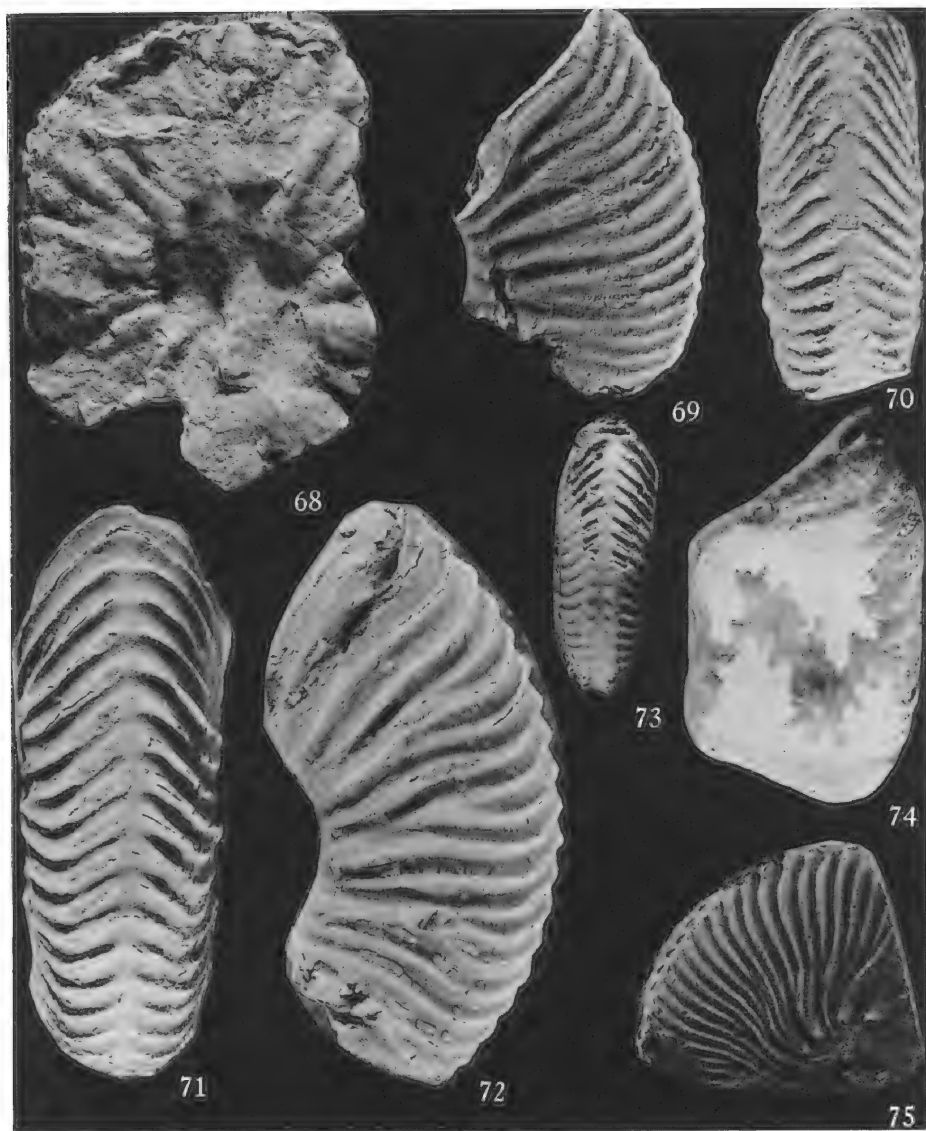


FIG. 68. *Thurmanniceras* sp. 1, I.P. No. 25106a. $\times 1$.

FIGS. 69–74. *Favrella colombiana*, new species. 69, 70. I.P. No. 74292a. $\times 1$. 71–73. I.P. No. 74292b (73, Plasticine cast of impressed zone). $\times 1$. 74. I.P. No. 25184b. $\times 1$.

FIG. 75. *Sarasinella hondana*, new species, holotype, I.P. No. 25143c. $\times 1$.

with the type species, *F. americana* (Favre), nor with *F. angulatiformis* (Behrendsen), both of which differ from it in their more uniform and less sigmoidal costation.

LOCALITIES: Rio Fonce, north of Socorro, department of Santander,



FIG. 76. *Favrella colombiana*, new species, holotype, I.P. No. 25184a. $\times 1$.

and the area of Pajarito, department of Boyacá and Intendencia Casanare.

AGE: Lower Hauterivian.

NEOCOSMOCERAS BLANCHET, 1922

As far as I am aware, once before this genus was recorded tentatively from Colombia, even from the same area (Gachalá) as our ?*Neocosmoceras* sp. 2, namely, by Royo y Gomez (1945a, p. 229, pl. 32, fig. 2b). To judge by his description, he may indeed have been dealing with a form belonging to this genus, but his illustration is so poor as to render identification impossible.

Neocosmoceras sp. 1

Figure 82

A single, poorly preserved imprint clearly shows the strong, triangular, peripheral tubercles characteristic of this rare genus. Within the genus *Neocosmoceras* it resembles, with its comparatively dense costation, consisting of broad, low ribs, certain other species illustrated by Mazenot (1939, pl. 29, fig. 3, pl. 30, figs. 1, 2, pl. 31, fig. 6, pl. 32, fig. 15) better than the type species, *N. sayni*, without, however, being fully identifiable with any of them. On the other hand, the poor preservation precludes creation of a new species.

LOCALITY: Quebrada Honda, department of Boyacá.

AGE: Upper Berriasian.

? *Neocosmoceras* sp. 2

Figure 84

Strong, triangular tubercles along the periphery suggest tentative reference of a whorl fragment with robust, stiff costation to this genus.

LOCALITY: Near Gachalá, department of Cundinamarca.

AGE: Upper Berriasian.

SARASINELLA UHLIG, 1905*Sarasinella hondana*, new species

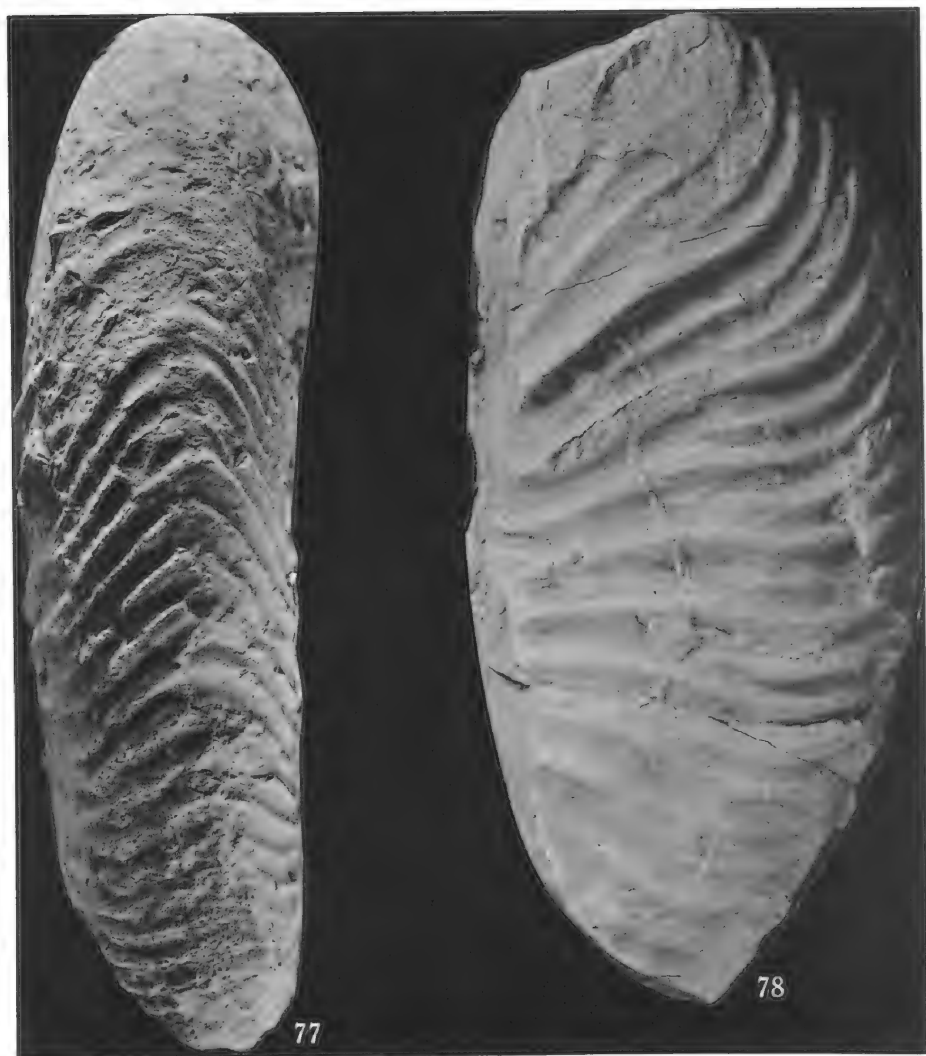
Figures 75, 81, 83, 85-87, 89-91, 95

Neocomites ? spec., BÜRGEL, 1957, pl. 3, fig. 3.

Protacanthodiscus spec., BÜRGEL, 1957, pl. 3, fig. 6.

This species attains considerable size; the diameter to which some fragments correspond may be estimated at from 15 to 20 cm.

In side view it is characterized by the regular, clearly defined, elegantly sigmoidal costation. The whorl fragment illustrated in figure 75 exhibits this character best and is therefore designated the holotype despite its incompleteness. At an early stage the ribs bifurcate on the umbilical shoulder, but later in development the bifurcation point



FIGS. 77, 78. *Favrella colombiana*, new species. 77. Holotype, I.P. No. 25184a. $\times 1$. 78. I.P. No. 67526. $\times 1$.

tends to move outward, first to the inner third, then to the middle, of the flanks. In maturity circumumbilical tubercles appear occasionally, and the costae become more decidedly sigmoidal (figs. 75, 81, 89, 91, 95).

Up to the adult stage (and in some individuals even up to the gerontic one) the ribs terminate on the lateroventral shoulder in pronounced tubercles which point diagonally forward and leave the median zone of the venter smooth. Where venters are observable, this aspect is most characteristic of the present species (fig. 85). However,



FIG. 79. *Favrella colombiana*, new species, I.P. No. 67526. $\times 1$.

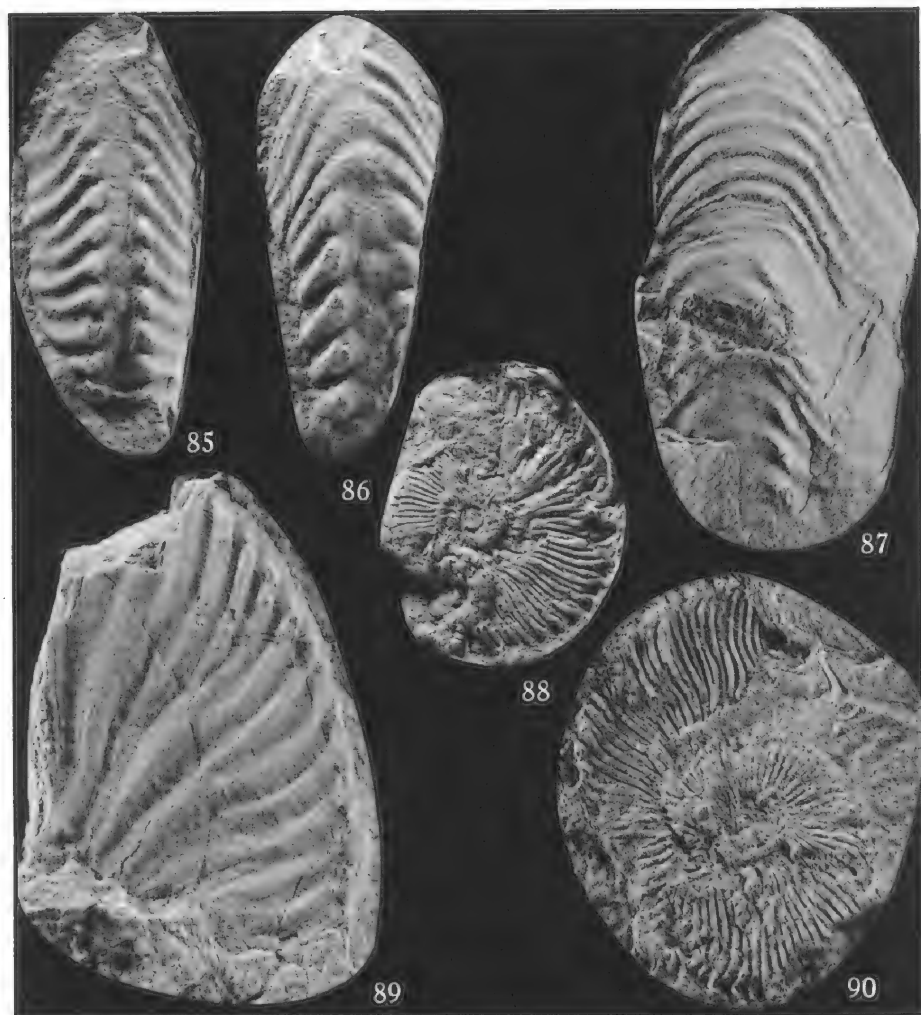
FIG. 80. *Sarasinella* sp. 2, I.P. No. 25108a. $\times 1$.

FIGS. 81, 83. *S. hondana*, new species. 81. I.P. No. 16259. $\times 1$. 83. Evolute variety, I.P. No. 25143i. $\times 1$.

FIG. 82. *Neocosmoceras* sp. 1, I.P. No. 25143. $\times 1$.

FIG. 84. ?*N.* sp. 2, I.P. No. 25125. $\times 1$.

it does not persist throughout development. At varying stages the tubercles become, sometimes quite suddenly, connected across the venter by a forward convex, rounded tongue (fig. 86). In the individual illustrated in figure 87 the tubercles disappear entirely and the ventral tongue becomes the direct continuation of the lateral ribs. It should be noted, however, that these tongues are always broad and



FIGS. 85-87, 89, 90. *Sarasinella hondana*, new species. 85-87, 89. I.P. Nos. 25143e, 25143f, 25143g, 25143d. $\times 1$. 90. Variety with fine and dense costation, I.P. No. 25143h (note long lateral lappet). $\times 1$.

FIG. 88. ?*S.* sp. 1, I.P. No. 25143a. $\times 1$.

well rounded and never assume the chevron-like aspect encountered in the genus *Favrella*.

This species is extremely variable as to the degree of involution, the strength and density of the costation, and other features of the ornamentation. The particularly evolute specimen shown in figure 83, which also exhibits primary ribs separated by unusually wide intercostals and regularly bifurcating at about the inner third of the flanks, may be considered a separate variety, as may the one illustrated

in figure 90 in which the costation is so fine and dense as to resemble that of *Substeueroceras*. This specimen also shows a long and narrow lateral lappet, as found also in other forms of our material referred to this genus (cf. fig. 92). The fine and dense costation mentioned above is found in some juveniles also.

REMARKS: Bürgl's forms from the same area listed in the synonymy are indistinguishable from some of the specimens here referred to *S. hondana* and are considered conspecific. Possibly this holds true also for other specimens illustrated in Bürgl's plate 3. The more finely and densely ribbed variety (fig. 90) somewhat resembles in the character of ornamentation the fragment from Gachalá described and illustrated by Royo y Gomez (1945a, p. 230, pl. 32, fig. 2c) as *Neocomites limensis* Lissón?, which also exhibits a similarly long and narrow lateral lappet.

See below for a comparison of the present species with others of the genus *Sarasinella*.

LOCALITIES: Quebrada Honda, department of Boyacá; near Gachalá, department of Cundinamarca.

AGE: Upper Berriasian.

?Sarasinella sp. 1

Figures 88, 94

Aspidoceratidae?, ROYO Y GOMEZ, 1945a, p. 225, pl. 30, fig. 1b.

Two individuals associated with *S. hondana* in the Quebrada Honda area deviate from all those included above in that species in that the outer ends of two or, exceptionally, three ribs join the same lateroventral tubercle. Furthermore, these tubercles are sharper than in *S. hondana* and become ear-shaped in the anterior half of the outer whorl of the larger one of these two disks; it exhibits, in addition to those outer tubercles and to the circumumbilical ones, two or three blunt tubercles at about the inner third of the flanks.

REMARKS: Although Uhlig [1910 (1903–1910), p. 172], in establishing the genus *Sarasinella*, emphasized the trituberculate sculpture of its early stages which, however, "disappears from the last volution," the scanty material available does not permit a safe decision as to whether these two specimens can be left with the genus *Sarasinella* or are subgenerically, or even generically, different. Until a decision is made, the present form is referred to Uhlig's genus with a question mark only.

Royo y Gomez' form from the same locality (see synonymy) shows the same peculiarities of ornamentation and is obviously conspecific.



FIG. 91. *Sarasinella hondana*, new species, I.P. No. 25143b. $\times 1$.

FIGS. 92, 93. *S. sp. 2*. 92. I.P. No. 25125 (note lateral lappet). $\times 1$. 93. I.P. No. 25108b. $\times 1$.

FIG. 94. ?*S. sp. 1*, I.P. No. 25108b. $\times 1$.

LOCALITY: Quebrada Honda, department of Boyacá.

AGE: Upper Berriasian.

Sarasinella sp. 2

Figures 80, 92, 93

?*Protacanthodiscus spec.*, BÜRGLE, 1957, pl. 3, fig. 5.

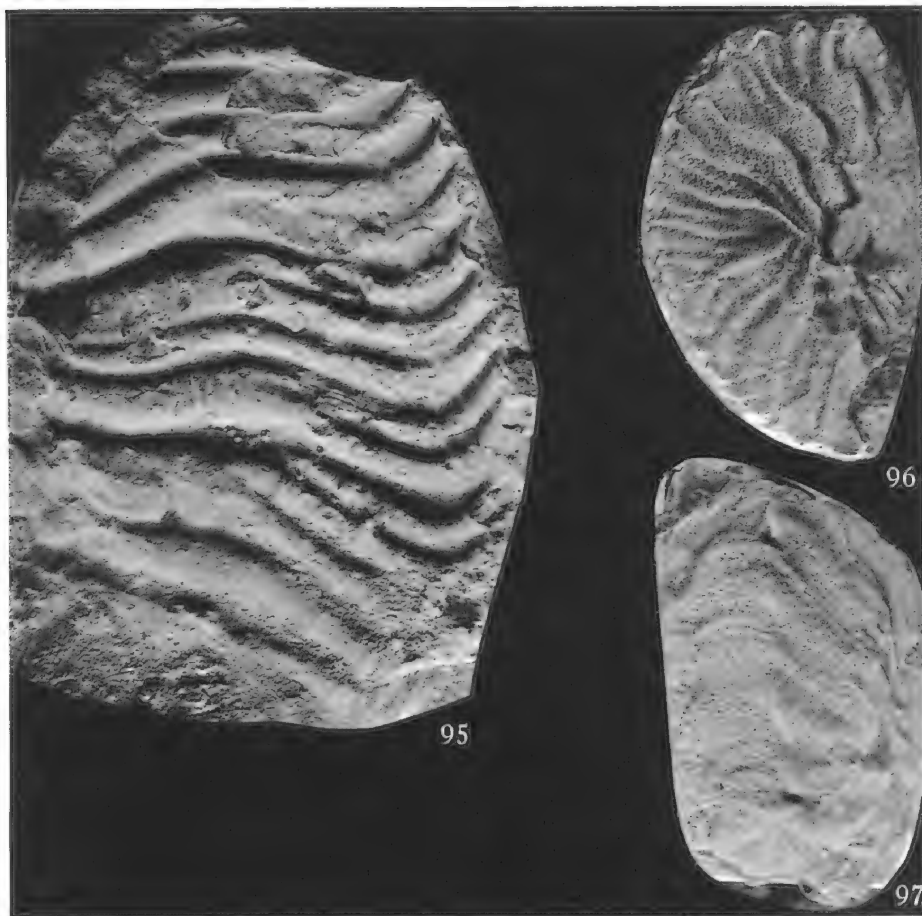


FIG. 95. *Sarasinella hondana*, new species, I.P. No. 25143a. $\times 1$.

FIGS. 96, 97. *S. sp. 3*, I.P. No. 20165 (specimen nos. 3088, 3089). $\times 1$.

The single disk illustrated in figure 92 measures about 50 mm. in diameter and is preserved up to the apertural margin, from which a rather long and straight lateral lappet projects. It differs from *S. hondana* in carrying, in addition to blunt circumumbilical and occasional lateroventral tubercles, three more tubercles, which resemble the circumumbilical ones, at about the middle of the flanks; ribs seem to bifurcate or trifurcate at these tubercles.

A fragment representing about one-sixth of a whorl and corresponding to a diameter of about 30 mm. (fig. 80) carries three somewhat radially elongated circumumbilical tubercles, from each of which two or three gently sigmoidal ribs originate, and three or four tubercles at the middle of the flanks. Another, considerably larger, fragment (fig. 93) exhibits only one circumumbilical tubercle and two blunt



FIG. 98. ?*Sarasinella* sp. 2 or ?*Berriasella* sp., I.P. No. 67215. $\times 1$.

ones at midflanks. Fortunately, a part of the venter is preserved on which the outer ends of the ribs of both sides can be seen to be directed diagonally forward and to leave smooth a narrow band or furrow between them. A third very small whorl fragment may well be conspecific.

REMARKS: This form has the presence of tubercles at the middle of

the flanks in common with those tentatively referred above to *Subalpinites*, but the decidedly sigmoidal course of the ribs, in addition to the characters of the venter mentioned above, supports reference to *Sarasinella*, especially as a trituberculate ornamentation is considered by Uhlig (for reference, see above) a generic character of *Sarasinella*, at least at early ontogenetic stages.

By way of appendix to this species, a flattened fragment of a body chamber, the anterior end of which corresponds to a diameter of about 150 mm., is mentioned here and illustrated in figure 98. It has sigmoidal ribs which, approaching the anterior end, seem to indicate the presence of a lateral lappet and which carry irregularly spaced tubercles, in addition to the circumumbilical ones, at the middle or at the outer third of the flanks. This form may belong to *Sarasinella* sp. 2, with which it is associated east of Santa Rosa de Viterbo, or it may belong to *Berriasella*. It resembles indeed some species of that genus, e.g., *B. ardescensis* Mazenot (1939, pl. 23, fig. 6a) and *B. laxicosta* (Steuer, 1897, pl. 18, figs. 4, 5).

LOCALITIES: Near Gachalá, department of Cundinamarca, and east of Santa Rosa de Viterbo, department of Boyacá.

AGE: Berriasian.

Sarasinella sp. 3

Figures 96, 97, 99

The half disk illustrated in figure 96, attaining a diameter of about 50 mm., stands out by its costation, with the ribs, in the posterior quarter whorl, carrying strong tubercles at the inner third of the flanks, where bifurcation occurs, and, in the anterior quarter whorl, being sharply raised and strongly bent forward in the same part of the sides. Another outstanding feature is the strong development of the peripheral tubercles and their ear-like aspect in side view. In a fragment of a markedly larger, apparently conspecific shell (fig. 97) from the same locality these tubercles in oblique-ventral view can be seen to be spirally compressed. As in the specimen referred to *S. hondana*, illustrated in figure 86, the venter is smooth between these tubercles in the posterior part of the fragment, but in the anterior part the tubercles from both sides unite in a forward convex tongue that bridges the median zone.

A whorl fragment of a disk which may have reached from 15 to 20 cm. in diameter (fig. 99) may belong to the same species. It shows the same strongly sigmoidal ribs as the large whorl fragment illustrated in figure 95 and referred to *S. hondana*, but the three primary ones carry

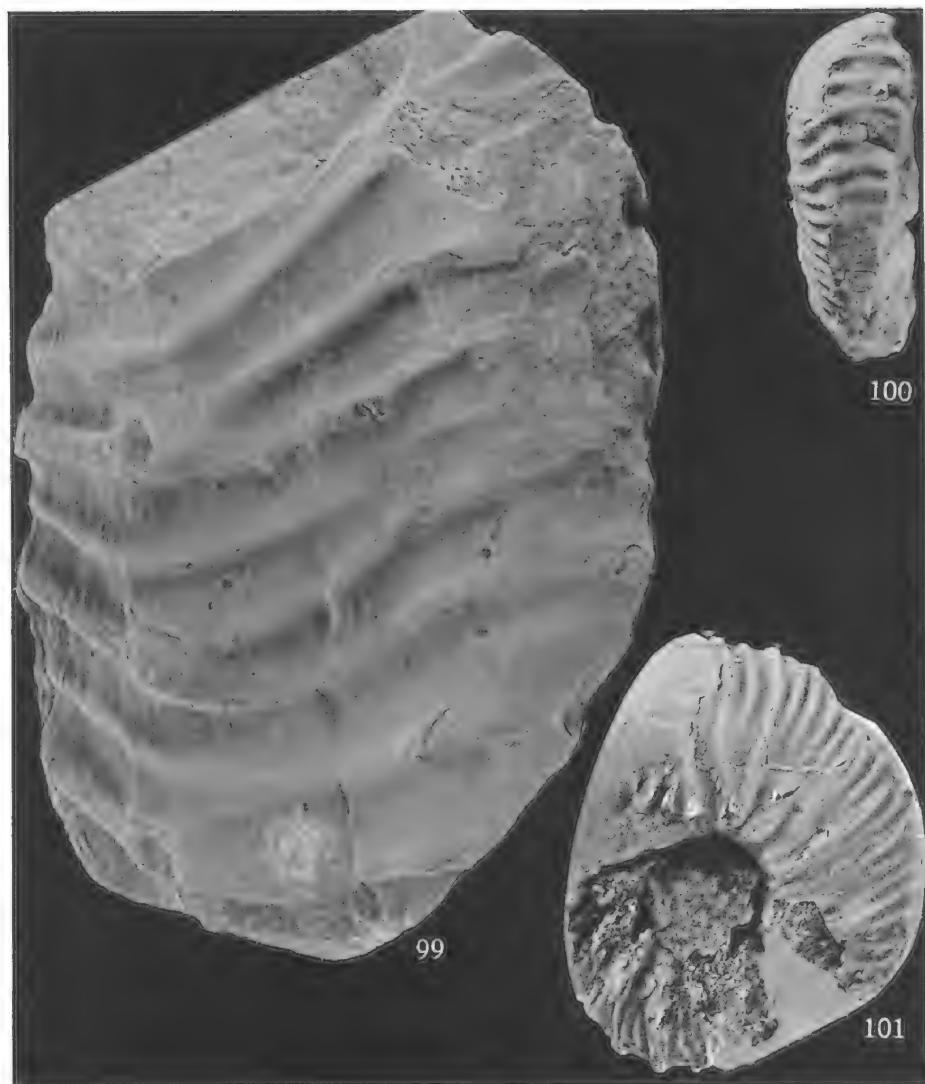


FIG. 99. *Sarasinella* sp. ?3, I.P. No. 9577. $\times 1$.

FIGS. 100, 101. ?*Acanthodiscus* sp., I.P. No. 14757. $\times 1$.

heavy tubercles on the umbilical shoulder, from which the high umbilical wall slopes at an angle of about 45 degrees. Bifurcation occurs at these tubercles, and single ribs are intercalated between the pairs that thus originate.

REMARKS: Because of the scarcity and incompleteness of the available material, the naming of a new species appears to be no more warranted for this form than for ?*Sarasinella* sp. 1 and *Sarasinella* sp. 2. Certain ornamentational characters, especially in the behavior of the ribs on the venter, suggest reference of this form to *Sarasinella* (of

which it may constitute a new subgenus), although it greatly resembles the younger (Hauterivian) genus *Acanthodiscus*. However, it lacks the latter's clasp-like, widely spaced primary ribs that connect the inner and middle tubercles. Reference to *Protacanthodiscus* Spath, 1923—a genus the separation of which from *Berriasella* I am inclined to consider unnecessary, as does Mazenot (1939, pp. 35, 77, 97)—would not be justifiable either, for the type species of that Tithonian genus, *Berriasella andraei* (Kilian), is markedly more evolute and stiffly ribbed.

LOCALITY: Near Quetame, department of Cundinamarca.

AGE: Probably Berriasian.

ACANTHODISCUS UHLIG, 1905

Acanthodiscus cf. *radiatus* (Bruguière)

Figures 102–106

Cf.

Ammonites radiatus Bruguière; d'ORBIGNY, 1840–1842, p. 110, pl. 26.

? *Acanthodiscus* cf. *radiatus* Brug.; ROYO Y GOMEZ, 1945a, p. 231, pl. 33, fig. 1b.

Acanthodiscus aff. *radiatus* (Bruguière); BÜRGEL, 1957, p. 132.

This form, which attains diameters of up to 170 mm., is characterized by two rows of heavy tubercles, one row riding on the umbilical shoulder, the other, at earlier ontogenetic stages, at the middle of the flanks but later moving farther outward. As can be seen best in figure 105, the inner and middle tubercles are connected by strong, straight, clasp-like, primary ribs, four of which are present on a quarter whorl. Secondary ribs, of which there are from 14 to 16 to a quarter whorl, radiate from the middle tubercles; others are inserted between the primary ribs. With growth all these secondary ribs tend to withdraw to the outer zone of the flanks. On the body chamber the costation degenerates and almost vanishes; only the circumumbilical tubercles maintain their strength (fig. 106). At an early age, the ribs end on the lateroventral shoulders in inconspicuous tubercles and remain separated on the venter, but later in development they unite on it in a forward convex tongue (fig. 104).

The flanks are only gently convex, and the venter is truncate; thus the lateroventral shoulders are pronounced, except in the gerontic stage.

The suture lines, observable in the whorl fragment F.N.M. No. K-2890 (fig. 105), agree well with d'Orbigny's drawing.

REMARKS: This form differs from the typical *A. radiatus* in being



FIG. 102. *Acanthodiscus* cf. *radiatus* (Bruguière), I.P. No. 25183a. $\times 1$.

a little more evolute and in having less conspicuous lateroventral tubercles.

Whether or not Royo's form doubtfully included in the synonymy is indeed identical with ours is impossible to decide on the strength of his description and figure; the fragment illustrated by Royo cannot readily be compared with our much larger specimens.

LOCALITY: North of Socorro, department of Santander.

AGE: Upper Hauterivian.



FIGS. 103, 104. *Acanthodiscus* cf. *radiatus* (Bruguière), I.P. Nos. 25183a, 25183b. $\times 1$.

?Acanthodiscus sp.

Figures 100, 101

The single specimen present is best dealt with by way of appendix to the preceding species.

The posterior portion of the outer whorl is characterized by high, radially compressed tubercles, at the middle of the flanks, in which the primary ribs culminate. They bifurcate into two secondary ribs

which unite again in an almost equally high lateroventral tubercle. Other secondary ribs are intercalated. In the anterior part of the outer whorl, however, the sharp tubercles of the middle of the flanks have disappeared, but the primary ribs are still strong and carry circumumbilical tubercles, the last rib a quite sharp one (fig. 101). The lateroventral tubercles, too, are pronounced and pointed, with occasionally two costae uniting in one of them. In the anteriormost portion of the whorl straight, horizontal ribs, slightly decreasing in strength in their median portion, connect the outer tubercles of both sides across the venter (fig. 100).

REMARKS: The prominence of the primary ribs in the inner zone of the flanks and the tubercles they form in the middle are ornamental features reminiscent of the genus *Acanthodiscus*, to which this single shell is therefore tentatively referred. Its smallness makes it difficult to compare it with our much larger individuals of *A. cf. radia-tus*, but a fragment representing the earliest stage present of that form (F.N.M. No. K-2884) is not so different in the character of the ornamentation.

LOCALITY: Southeast of La Salina, department of Boyacá.

AGE: ?Hauterivian.

FAMILY OOSTERELLIDAE BREISTROFFER, 1940

OOSTERELLA KILIAN, 1911

Oosterella colombiana, new species

Figures 107, 108

As this is the first record of the genus from the Western Hemisphere, if Royo's (1945a, p. 231) doubtful one is left out of account, this species is being named despite the fact that it is represented by only a single, rather poorly preserved whorl fragment which thus constitutes its holotype.

It is moderately evolute and has an inverted heart-shaped whorl profile, with a rather steep umbilical wall, gently convex flanks, pronounced lateroventral shoulders, and a truncate venter overtopped by a strong median keel, the original sharpness of which seems to have been blunted by corrosion.

The ornamentation consists of heavy, falciform ribs, of which the primary ones originate from circumumbilical tubercles. Secondary costae originate by bifurcation of the primary ones or by insertion between the inner third and the middle of the flanks. In the outer zone of the flanks all ribs are uniformly swollen so as to form blunt tubercles which point diagonally forward; they end at, or at some

distance from, the median keel. Nine ribs per quarter whorl are counted along the periphery.

Suture lines are visible enough to permit recognition of their rather rich indentation, of a comparatively wide siphonal lobe, of a high and wide external saddle, of a trifold first lateral lobe, of a lateral saddle, which is lower than the external one, and of a second lateral lobe and a low saddle beyond it.

REMARKS: This species differs from *O. cultrata* (d'Orbigny), the type species of *Oosterella*, in being stouter and in its somewhat heavier and more dense costation.



FIG. 105. *Acanthodiscus* cf. *radiatus* (Bruguière), F.N.M. No. K-2890. $\times 1$.

Royo y Gomez' (1945a, p. 231) ?*Oosterella* sp. is believed to be a *Pseudoosterella* (see below).

LOCALITY: Near Cáqueza, department of Cundinamarca.

AGE: Lower Hauterivian.

PSEUDOOSTERELLA SPATH, 1924

This genus, based on one of several micromorphic species described by Nicklès (1892) under the generic name *Mortoniceras* from southeastern Spain, is represented in our material by the following two species, the first of which attains a size markedly larger than that of Nicklès' species (apparently juveniles or members of a dwarfed fauna) and a size larger than that of two specimens from southwestern France referred to two of Nicklès' species by Sayn (1901).



FIG. 106. *Acanthodiscus* cf. *radiatus* (Bruguière), I.P. No. 25183b. $\times 1$.

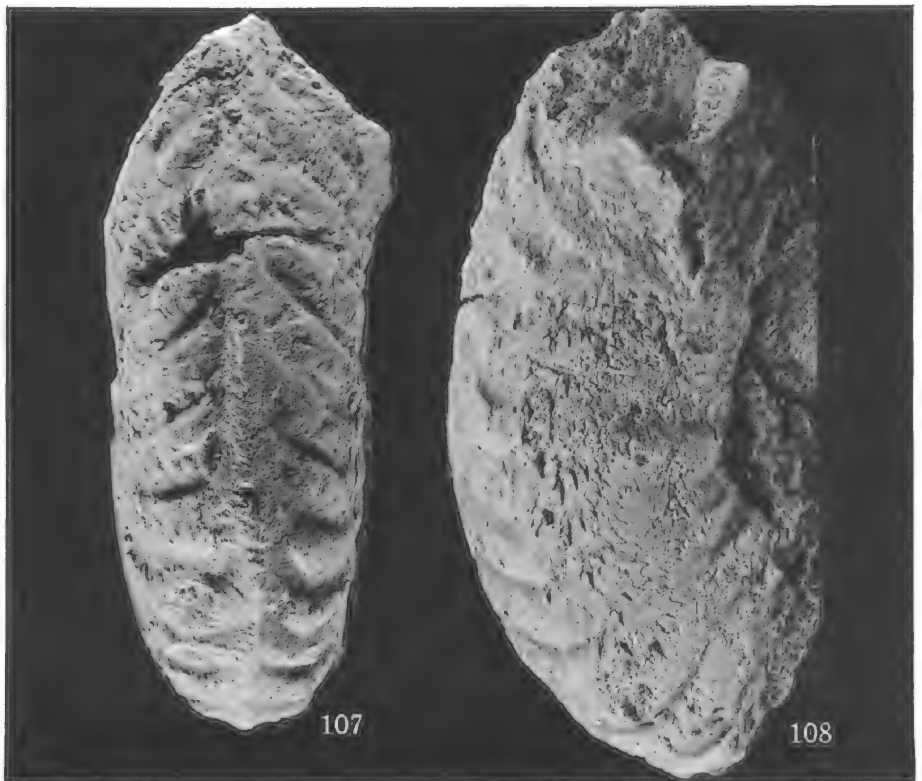
Hitherto known only from Europe (Spain, France, and Switzerland), this genus is recorded from South America for the first time in the present paper—at least under its proper name.

***Pseudoosterella ubalaensis*, new species**

Figures 109–119, 121, 122

Oosterella ? sp., ROYO Y GOMEZ, 1945a, p. 231.

This species is most commonly represented in the shales by small disks, and imprints thereof, measuring from 12 to 25 mm. in diameter



FIGS. 107, 108. *Oosterella colombiana*, new species, holotype, F.N.M. No. K-3234. $\times 1$.

and obviously juveniles, most of which are elliptically distorted by structural forces. Among the tolerably preserved individuals only the one illustrated in figures 121 and 122 attains a diameter of nearly 40 mm.; it is believed to represent the mature stage and is therefore designated the holotype. Badly corroded disks measuring about 65 mm. in width and possibly an even larger one which attains 115 mm. in diameter may, with due reservations, also be referred to this species.



FIGS. 109–117. *Pseudoosterella ubalaensis*, new species. 109–111, 113. I.P. Nos. 25128c, 25128a, 25128d, 25128b. $\times 2$. 112, 115–117. I.P. Nos. 25126e, 25126d, 25126c, 25126a. $\times 2$. 114. I.P. No. 25104a (imprint). $\times 2$. (Note keel or imprint thereof in figs. 110–112, 115.)

An outstanding characteristic is the median keel which extends into a long rostrum (figs. 118, 119).

This species displays a thrilling ontogeny and a bewildering range of variation, largely owing to the fact that certain ontogenetic changes occur in different individuals at different sizes. Therefore, if the present description is to be of any use, the ontogeny must be followed rather closely.

The earliest stages are entirely smooth (figs. 110, 113). Then short,



FIGS. 118, 119, 121, 122. *Pseudoosterella ubalaensis*, new species. 118, 119. I.P. No. 25126g (119, imprint). $\times 2$. 121, 122. Holotype (121, imprint), I.P. No. 25128e. $\times 1$. Note keel.

FIG. 120. *P. sp.*, I.P. No. 25104. $\times 2$. Note keel.

FIGS. 123, 124. *Subsaynella boyacaensis*, new species. 123. I.P. No. 25106a (imprint). $\times 1$. 124. Holotype, I.P. No. 25106c. $\times 1$.

radial ribs or folds appear which are restricted to the outer half of the flanks (figs. 109, 115, 116); they soon change into blunt peripheral beads (figs. 114, 115, 117). Juveniles with such plump beads, best exemplified by figures 114 and 117, serve as valuable index fossils for the shales in which they occur. At diameters varying between 15 and 25 mm. these beads are in turn replaced by ribs that are at first fine and closely set and become gradually coarser (figs. 112, 115, 116), but mostly remain restricted to the outer zone of the flanks (figs. 116, 118, 119). At a still later stage, corresponding to diameters of from 25 mm. to about 35 mm. and best represented by the holotype (figs. 121, 122), the ribs extend all over the flanks and in places become slightly sigmoidal. Thus the side view assumes an *Arietites*- or *Arietiaceras*-like aspect. A similar character of ornamentation may be observed

in the above-mentioned, considerably larger disks which are tentatively also referred to this species.

The keel and the rostrum into which the former continues can be observed clearly in only some of the small disks. At a larger diameter (of about 33 mm.) the keel can best be seen in the short whorl fragment illustrated in figure 111.

REMARKS: In its varying aspects this species resembles some of the "*Mortoniceras*" species of Nicklès (1892), chiefly his "*M.*" *gaudryi*, *garciae*, and *fischeri*, but it cannot possibly be identified with any of those minute forms. "*Mortoniceras*" *fischeri*, for one, assumes the *Arietites*- or *Arietoceras*-like aspect exhibited by our holotype (and, possibly, by much larger disks) as early in development as at a diameter about one-third of that of our holotype; it also shows a beaded, or tuberculate, keel not observable in the present species.

Royo y Gomez' (*loc. cit. in synonym.*) description leaves little doubt but that his *Oosterella* ? sp. from Ubalá belongs to our new species.

LOCALITIES: Near Ubalá, department of Cundinamarca; possibly also near Gachalá in the same department, and near Quebrada Honda, department of Boyacá.

AGE: Lower Valanginian, possibly also late Berriasian.

Pseudoosterella sp.

Figure 120

The single whorl fragment so designated is also distinctly keeled, but it exhibits only a most subdued, hardly perceptible costation. The shell to which it belongs also seems to have been more involute than the shells referred to *P. ubalaense*. This fragment is therefore believed to be specifically different.

LOCALITY: Near Ubalá, department of Cundinamarca.

AGE: Lower Valanginian.

SUPERFAMILY DESMOCERATACEAE ZITTEL, 1895

FAMILY DESMOCERATIDAE ZITTEL, 1895

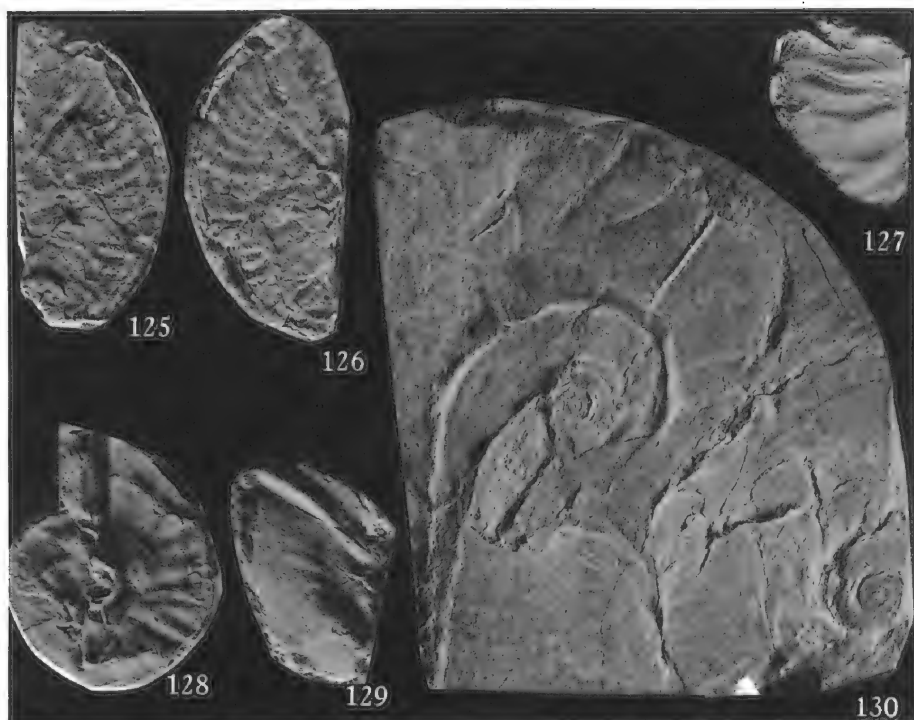
SUBFAMILY EODESMOCERATINAE WRIGHT, 1955

SUBSAYNELLA SPATH, 1923

Subsaynella boyacaensis, new species

Figures 123-127

Associated at the same locality with the crushed disks tentatively referred above to the genus *Neolissoceras* are other crushed disks that attain diameters up to 75 mm. They are similarly involute but carry a different ornamentation, namely, falciform growth folds or flat ribs



FIGS. 125–127. *Subsaynella boyacaensis*, new species. 125, 126. I.P. No. 25106b (126, imprint). $\times 1$. 127. I.P. No. 25106d. $\times ca. 2$.

FIGS. 128–130. *?Pseudohaploceras* sp. 128. I.P. No. 25106 (imprint). $\times 1$. 129. Partial view of I.P. No. 25120a. $\times 1$. 130. I.P. No. 25120b. $\times 1$.

which become more pronounced in the outermost zone of the flanks.

The specimen illustrated in figure 124 is designated the holotype; it is the only one present that exhibits a shallow constriction running parallel to the ribs.

REMARKS: The characters just described seem to justify reference of this form to the genus *Subsaynella*, hitherto known only from the Old World.

LOCALITIES: South of Santa Rosa de Viterbo, department of Boyacá; possibly also southwest of Arcabuco in the same department.

AGE: Hauterivian.

SUBFAMILY PUZOSIINAE SPATH, 1922

PSEUDOHAPLOCERAS HYATT, 1900

?Pseudohaploceras sp.

Figures 128–130

In addition to *?Neolissoceras* sp. and *Subsaynella boyacaensis*, a third smooth, or nearly smooth, form has been collected from the same

and one other locality. All the specimens referred to it are also flattened. It is believed to be generically different from both the aforementioned forms and, on the strength of its varices, is referred to the genus *Pseudohaploceras*, although only tentatively.

The imprint of a rather involute disk illustrated in figure 128, measuring 33 mm. in diameter, exhibits four broad, straight, somewhat prorsiradiate impressions of varices on the anterior third of the outer whorl.

A disk measuring 48 mm. in width and several imprints attaining diameters up to 60 mm. exhibit similar varices (figs. 129, 130) and are believed to be conspecific. This form seems to become markedly more evolute with growth. Some of these individuals show a delicate costation in the outermost zone of the flanks.

REMARKS: This form, represented exclusively by totally crushed specimens, is difficult to compare with the undeformed *P. inca* (Forbes) recorded and illustrated by Bürgl (1957, p. 133, pl. 5, fig. 3) from the Barremian of Utica, department of Cundinamarca. However, even with the difference in preservation taken into account, Bürgl's form seems to be more evolute.

LOCALITIES: South of Santa Rosa de Viterbo, department of Boyacá, and south of Fomeque, department of Cundinamarca.

AGE: Hauterivian.

FAMILY HOLCODISCIDAE SPATH, 1924

SPITIDISCUS KILIAN, 1907

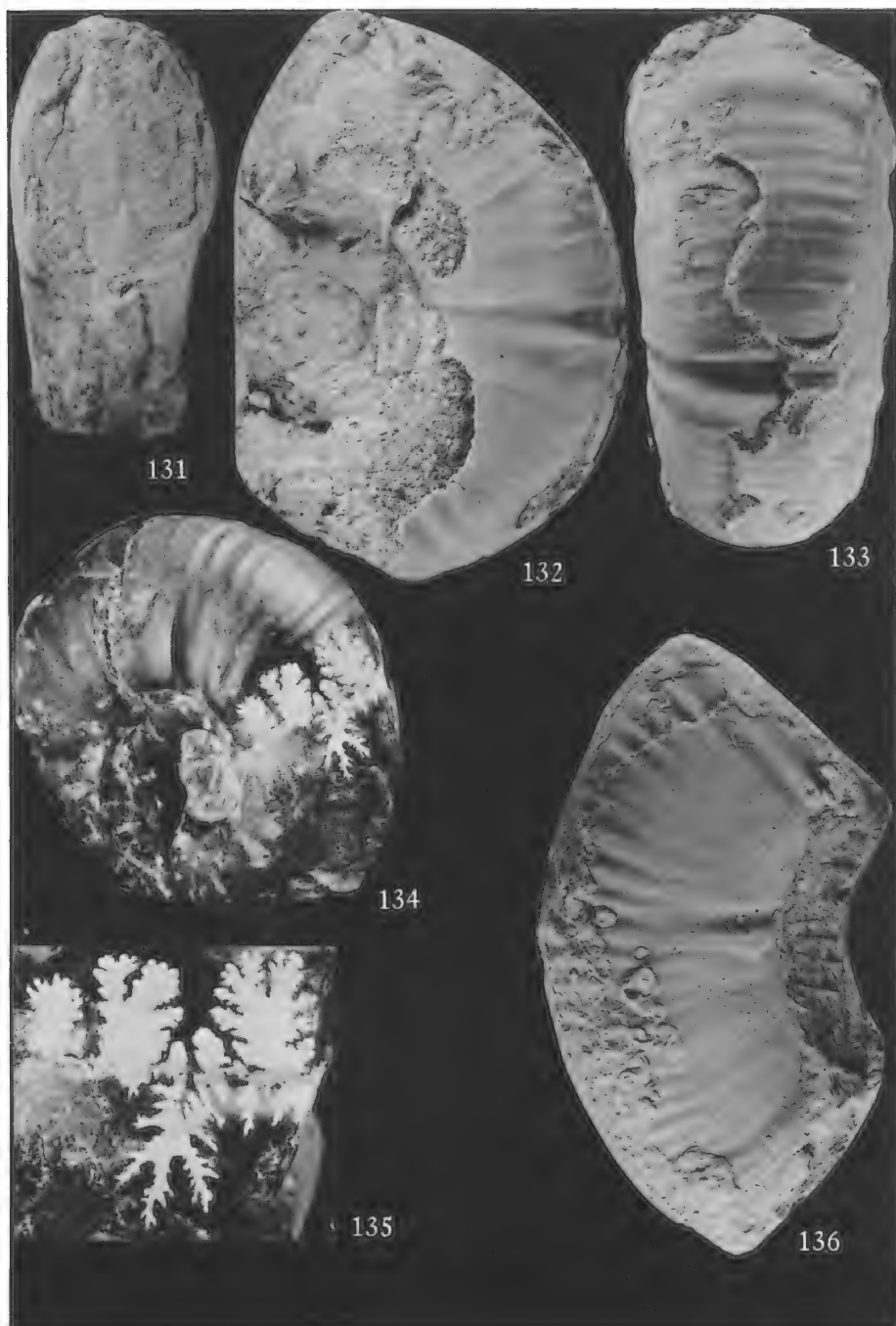
Spitidiscus simitiensis, new species

Figures 132-135

This species, attaining about 70 mm. in diameter, is rather evolute and has a well-rounded whorl profile; only the largest individual (fig. 133) shows a slightly truncate venter. This form is characterized by wide and rather deep constrictions, four to a half whorl, which are bounded by rather sharp primary ribs or by blunt varices. Other primary ribs occur between constrictions, and from three to eight secondary ribs, which sometimes bifurcate, are inserted between the primary ones. Both costae and constrictions run straight, or nearly so, across the flanks and cross the venter uninterruptedly, forming an extremely shallow forward convex arc.

The last suture lines are clearly recognizable in the holotype (figs. 134, 135); they are quite elaborate, with a richly indented, trifid, first lateral lobe.

REMARKS: Agreement in essential characters with the type species



FIGS. 131, 136. ?*Spitidiscus* sp., I.P. No. 64033. $\times 1$.

FIGS. 132–135. *Spitidiscus simitiensis*, new species. 132, 133. I.P. No. 63009. $\times 1$. 134, 135. Holotype, I.P. No. 74181. 134. $\times 1$. 135. Suture lines. $\times 2$.

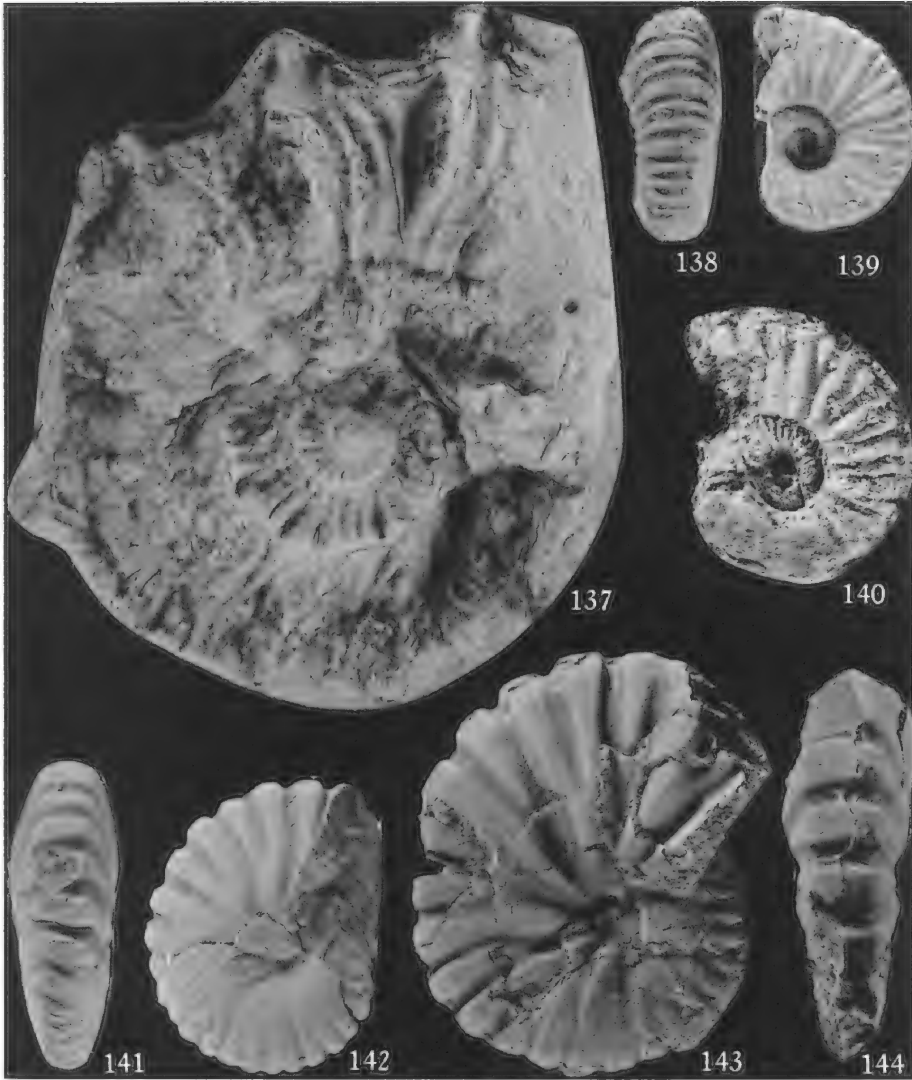


FIG. 137. *Holcodiscus* cf. *camelinus* (d'Orbigny), I.P. No. 66343. Slightly reduced.

FIGS. 138-140. ?*Colombiceras* sp. 138, 139. I.P. No. 25187b. $\times 2$. 140. I.P. No. 25187a. $\times 1$.

FIGS. 141-144. *Nicklesia dumasiana* (d'Orbigny), I.P. Nos. 25187b, 25187c. $\times 1$.

of this genus, *S. rotula* (Sowerby), seems to justify the reference of this form to Kilian's genus. It is, however, more evolute than *S. rotula*, and both costae and constrictions run a much straighter course than in that species.

LOCALITIES: Near Simiti, department of Bolivar, and (loose) in the

middle Magdalena Valley, department of Magdalena.

AGE: Barremian.

?Spitidiscus sp.

Figures 131, 136

The well-preserved whorl fragment shown in the figures can only doubtfully be referred to *Spitidiscus*. It may belong to a specimen of *Crioceratites*.

REMARKS: It differs from *S. simitiensis* in being markedly more slender and in its flat flanks.

LOCALITY: North of Cáqueza, department of Cundinamarca.

AGE: ?Barremian.

HOLCODISCUS UHLIG, 1883

Holcodiscus cf. *camelinus* (d'Orbigny)

Figure 137

Cf. *Ammonites camelinus* D'ORBIGNY, 1850, p. 197, pl. 8, figs. 1-4.

This form, and the genus to which it is referred, are represented in the collections by the illustrated specimen only. It is a rather evolute disk, preserved in part as an imprint and in part fully, which attains 90 mm. in diameter. It is characterized by heavy and high, gently sigmoidal primary ribs, about four to a quarter whorl, which continue beyond the periphery into strong, high spines. About three much less conspicuous secondary ribs are intercalated between every two primary ribs.

REMARKS: This form agrees fairly closely with d'Orbigny's (*loc. cit. in synon.*) species from the "Neocomian" (Barremian) of Escagnolles in southern France but is about two and one-half times as large as the type of that species. This considerable difference in size precludes proper comparison and full identification.

LOCALITY: Rio Cusiana, about 14 kilometers south-southwest of Pajarito, department of Boyacá.

AGE: Barremian.

SUPERFAMILY HOPLITACEAE H. DOUVILLÉ, 1890

FAMILY PULCHELLIIDAE HYATT, 1903

This family, which only recently has been the subject of an excellent, comprehensive treatment by Bürgl (1956), is represented at only two of the many localities from which collections have been made. Therefore it is only cursorily treated here.

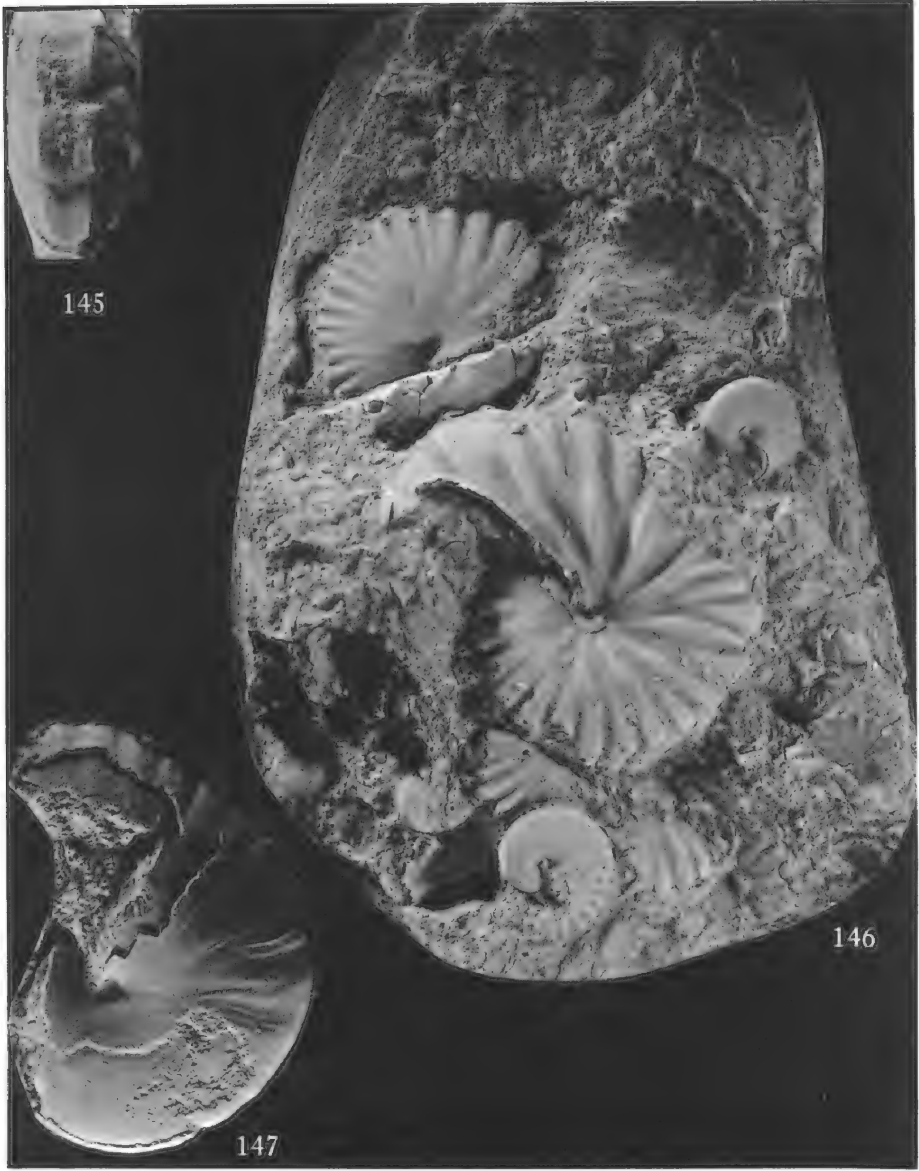


FIG. 145. *Pulchellia* sp., I.P. No. 25186. $\times 1$.
FIGS. 146, 147. *Nicklesia dumasiana* (d'Orbigny). 146. I.P. No. 25187d. $\times 1$.
147. Juvenile, I.P. No. 25187a. $\times 2$.

PULCHELLIA UHLIG, 1883

Pulchellia sp.

Figure 145

Only the single whorl fragment shown in the illustration and per-

haps a poorly preserved disk associated with it are referable to *Pulchellia*.

The fragment shows the intermittent lateroventral keels, formed by the outer ends of the ribs, which are characteristic of this genus. Between these keels the venter is slightly sunk.

LOCALITY: East of Socorro, department of Santander.

AGE: Barremian.

NICKLESIA HYATT, 1903

Nicklesia dumasiana d'Orbigny

Figures 141–144, 146, 147

Nicklesia dumasiana d'Orb.; RIEDEL, 1938, p. 63, pl. 11, figs. 1, 2.

Nicklesia dumasiana (d'Orbigny); BÜRGEL, 1956, p. 48, *cum synonym.*, pl. 2, fig. 4, pl. 3, figs. 2–6, pl. 7, figs. 1–5, pl. 8, figs. 1–8, pl. 9, figs. 1–3.

Many juveniles and small individuals and some adults attaining diameters of from 50 to 55 mm. were collected at the first of the localities mentioned below.

Up to diameters of from 12 to 17 mm. the juveniles are smooth, then a fine, sigmoidal growth striation sets in, then ribs appear, first on the periphery (fig. 147), then gradually extending to the umbilicus which remains extremely narrow throughout development. In maturity the ribs are broad and heavy and, though varying in width, always wider than the intercostals. As a rule, longer primary and shorter secondary ribs alternate; the primary ones bifurcate only exceptionally. From 26 to 32 costae are counted around the periphery. On the flanks the ribs are mostly straight and radial, only occasionally slightly sinuous. They are widest and highest on the venter which they cross in a straight line. The venter is narrow and truncate but never sunk, nor do spirally elongated tubercles, as they mark the outer ends of the ribs in *Pulchellia*, ever appear on the otherwise quite pronounced lateroventral shoulders.

REMARKS: Most of the specimens studied are believed to belong to the *forma typica*, as interpreted by Bürgel, of this very variable species. However, the individual illustrated in figure 142 may be referable to Bürgel's subspecies *retrocurvata* (1956, p. 50, pl. 9, figs. 2, 3), the type of which (*ibid.*, fig. 2) it closely resembles.

LOCALITIES: East bank of the Rio Suárez at Eduardo Santos Bridge, about 20 kilometers north of Socorro, department of Santander; possibly also east of Socorro.

AGE: Barremian.

FAMILY DOUVILLEICERATIDAE PARONA AND BONARELLI, 1897

SUBFAMILY ACANTHOHOPLITINAE STOJANOW, 1949

COLOMBICERAS SPATH, 1923

?Colombiceras sp.

Figures 138-140

Associated with, but definitely different from, the many *Nicklesia* specimens collected at the first of the two above-named localities were a juvenile and a larger individual, measuring 14 and 35 mm., respectively, in diameter. They are tentatively referred to *Colombiceras*, although this genus is generally considered Aptian in age.

The juvenile is moderately evolute, the larger disk considerably more so. The flanks are well rounded, and the venter is slightly truncate. Longer primary and shorter secondary ribs alternate; only occasionally do two secondary ones originate by bifurcation of a primary rib. On the last half whorls of both specimens 17 costae are counted along the periphery. All of them run nearly straight, both on the flanks, where they follow a radial direction, and on the venter which they cross uninterruptedly. A single constriction is present in the juvenile.

REMARKS: Within the genus *Colombiceras*, should this form indeed belong to it, it is comparable but not conspecific with *C. aff. tobleri* Jacob in Riedel, 1938 (pl. 8, figs. 23, 24).

LOCALITY: East bank of the Rio Suárez at Eduardo Santos Bridge, about 20 kilometers north of Socorro, department of Santander.

AGE: Barremian.

STRATIGRAPHIC SYNOPSIS

In conclusion, the forms discussed in the present report are listed in ascending stratigraphic sequence:

LOWER BERRIASIAN: *Substeuroceras mutabile* Haas.

BERRIASIAN: *Leptoceras hubachi* (Royo), *Leptoceras* sp., *Kossmatia viterboensis* Haas, *Berriasella* sp. 3, *Sarasinella* sp. 2, probably also *Sarasinella* sp. 3.

UPPER BERRIASIAN: *Berriasella* sp. 1, *Berriasella* sp. 2, ? *Subalpinites* cf. *quadripartitus* (Steuer), ? *Subalpinites* sp. 1, ? *Subalpinites* sp. 2, *Substeuroceras permulticostatum* (Steuer), *Neocosmoceras* sp. 1, ? *Neocosmoceras* sp. 2, *Sarasinella hondana* Haas, ? *Sarasinella* sp. 1.

UPPER BERRIASIAN-LOWER VALANGINIAN: *Berriasella* forma juv.

LOWER VALANGINIAN: *Leptoceras ubalaense* Haas, *Pseudoosterella ubalaensis* Haas (possibly occurring already in the upper Berriasian), *Pseudoosterella* sp.

VALANGINIAN: *Berriasella colombiana* Haas.

PROBABLY UPPER VALANGINIAN: *Olcostephanus* sp., *Olcostephanus delicatocostatus* Haas.

VALANGINIAN OR LOWER HAUTERIVIAN: *Olcostephanus bösei* Riedel.

UPPER VALANGINIAN-HAUTERIVIAN: *Subastieria* aff. *sulcosae* Pavlow and Lamplugh.

LOWER HAUTERIVIAN: *Olcostephanus* cf. *astierianus* (d'Orbigny), *Olcostephanus* aff. *atherstoni* (Sharpe), *Favrella colombiana* Haas, *Oosterella colombiana* Haas.

HAUTERIVIAN: ?*Hamulina* sp., ?*Neolissoceras* sp., *Spiticeras* (*Kilianiceras*) cf. *damesi* (Steuer), *Thurmanniceras santaros anum* Haas, *Thurmanniceras* sp. 1, *Thurmanniceras* sp. 2, *Subsaynella boyacaensis* Haas, *Pseudohaploceras* sp.

?HAUTERIVIAN: ?*Acanthodiscus* sp.

UPPER HAUTERIVIAN: *Olcostephanus* cf. *laticosta* Gerth, *Acanthodiscus* cf. *radiatus* (Bruguière).

BARREMIAN: *Spitidiscus simitiensis* Haas, *Holcodiscus* cf. *camelinus* (d'Orbigny), *Pulchellia* sp., *Nicklesia dumasiana* (d'Orbigny), *Colombiceras* sp.

SUPPOSEDLY BARREMIAN: ?*Parancyloceras* sp.

?BARREMIAN: ?*Raimondiceras* sp., ?*Spitidiscus* sp.

POSTSCRIPT

Only after the conclusion of the present paper did Sato's (1958) study on the Berriasian of Japan come to the writer's attention. Even at first sight the similarity between the ammonites there illustrated and the Colombian ones here dealt with is quite obvious. Most striking are the following resemblances:

1. The costation of Sato's *Olcostephanus*, new species, is nearly as fine as that of my *O. delicatecostatus*, but in his form the shell shape is globular.

2. Among the specimens referred by Sato to *Thurmanniceras isokusensis* (should read "*isokusense*") the one illustrated in his figure 9 shows primary ribs similarly thickened as in the individual doubtfully referred above (p. 17, fig. 36) to *Berriasella* sp. 2 which is, however, less evolute. The one illustrated in Sato's figure 10 exhibits the same abrupt increase in width of the intercostals between the primary ribs as one of the paratypes (fig. 51) of my *Substeueroceras mutabile*. However, Sato emphasizes the presence of a siphonal groove in that specimen, and this character would exclude its reference to *Substeueroceras*. Thus the similarities here pointed out may well be interpreted as parallelisms or minor convergences within the family Berriasellidae (as circumscribed by Arkell *et al.*, 1957) rather than as evidence of congenerity or even conspecificity. After all, the close similarity between more or less all members of this family is undeniable.

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